



National Aeronautics and  
Space Administration

**NSTS 21111**

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**Lyndon B. Johnson Space Center**  
Houston, Texas 77058

## **SPACE SHUTTLE**

# **GENERIC INTEGRATED CARGO HAZARD ASSESSMENT REPORT**

**MAY 2, 1996**

## REVISION LOG

REV LTR	CHANGE NO	DESCRIPTION	DATE
		BASELINE ISSUE (Reference: Space Shuttle PRCBD S041327B, dated 3/25/96)	05/02/96

CHANGE SHEET

FOR

NSTS 21111 – Space Shuttle  
Generic Integrated Cargo Hazard Assessment Report

CHANGE NO. 2

Program Requirements Control Board Directive No. S061319A/(2-1), dated 7/29/00.(1)

August 18, 2000

Robert H. Heselmeyer  
Secretary, Program Requirements  
Control Board

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CHANGE INSTRUCTIONS

1. Remove the following listed pages and replace with the same numbered attached pages:

<u>Page</u>	<u>PRCBD No.</u>
4-15	
4-16 - 4-17	S061319A
4-18	

NOTE: A black bar in the margin indicates the information that was changed.

2. Remove the List of Effective Pages, dated August 31, 1998 and replace with List of Effective Pages, dated August 18, 2000.
3. Sign and date this page in the space provided below to show that the changes have been incorporated and file immediately behind the List of Effective Pages.

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Signature of person incorporating changes

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Date

NSTS 21111 - Space Shuttle  
Generic Integrated Cargo Hazard Assessment Report

LIST OF EFFECTIVE PAGES

August 18, 2000

The current status of all pages in this document is as shown below:

<u>Page No.</u>	<u>Change No.</u>	<u>PRCBD No.</u>	<u>Date</u>
i - ii	Baseline	S041327B	March 25, 1996
iii	1	S041327C	August 6, 1998,
		SSP DOC-406	August 26, 1998
iv - vii	Baseline	S041327B	March 25, 1996
viii	1	S041327C	August 6, 1998
ix - xiv	Baseline	S041327B	March 25, 1996
1-1 - 1-2	Baseline	S041327B	March 25, 1996
2-1	Baseline	S041327B	March 25, 1996
2-2	1	S041327C	August 6, 1998
3-1 - 3-2	1	S041327C	August 6, 1998
4-1 - 4-8	Baseline	S041327B	March 25, 1996
4-9 - 4-10	1	S041327C	August 6, 1998
4-11	Baseline	S041327B	March 25, 1996
4-12	1	S041327C	August 6, 1998
4-13	Baseline	S041327B	March 25, 1996
4-14 - 4-15	1	S041327C	August 6, 1998
4-16 - 4-17	2	S061319A	July 29, 2000
4-18	1	S041327C	August 6, 1998
4-19 - 4-21	Baseline	S041327B	March 25, 1996
4-22	1	S041327C	August 6, 1998
4-23	Baseline	S041327B	March 25, 1996
4-24 - 4-26	1	S041327C	August 6, 1998
4-27	Baseline	S041327B	March 25, 1996
4-28	1	S041327C	August 6, 1998
4-29	Baseline	S041327B	March 25, 1996
4-30	1	S041327C	August 6, 1998
4-31 - 4-40	Baseline	S041327B	March 25, 1996
A-1 - A-2	Baseline	S041327B	March 25, 1996
A-3 - A-4	1	S041327C	August 6, 1998
A-5 - A-6	Baseline	S041327B	March 25, 1996
B-1 - B-4	Baseline	S041327B	March 25, 1996

## LIST OF EFFECTIVE PAGES

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The current status of all pages in this document is as shown below:

<u>Page No.</u>	<u>Change No.</u>	<u>PRCBD No.</u>	<u>Date</u>
B-5 - B-6	1	S041327C	August 6, 1998
B-7 - B-10	Baseline	S041327B	March 25, 1996
C-1 - C-2	Baseline	S041327B	March 25, 1996
C-3	1	S041327C	August 6, 1998
C-4	Baseline	S041327B	March 25, 1996
D-1 - D-3	Baseline	S041327B	March 25, 1996
D-4	1	S041327C	August 6, 1998

**NSTS 21111**

**SPACE SHUTTLE**

**GENERIC INTEGRATED CARGO  
HAZARD ASSESSMENT REPORT**

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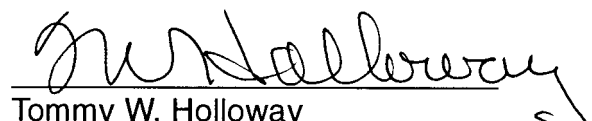
## FOREWORD

Efficient management of the Space Shuttle Program (SSP) dictates that effective control of program activities be established. Requirements, directives, procedures, interface agreements, and system capabilities shall be documented, baselined, and subsequently controlled by SSP management.

Program requirements controlled by the Manager, Space Shuttle Program, are documented in, attached to, or referenced from NSTS 07700, Volumes I through XVIII.

This Generic Integrated Cargo Hazard Assessment Report (GICHAR) is developed to satisfy the SSP's requirement to ensure safe integration/operation of shuttle cargo. The GICHAR satisfies this requirement by documenting the list of standard hazards, their causes, and controls. Each control is then documented with one or more verification(s) to ensure the cause is controlled, and identify the responsible organization(s) required to perform each verification.

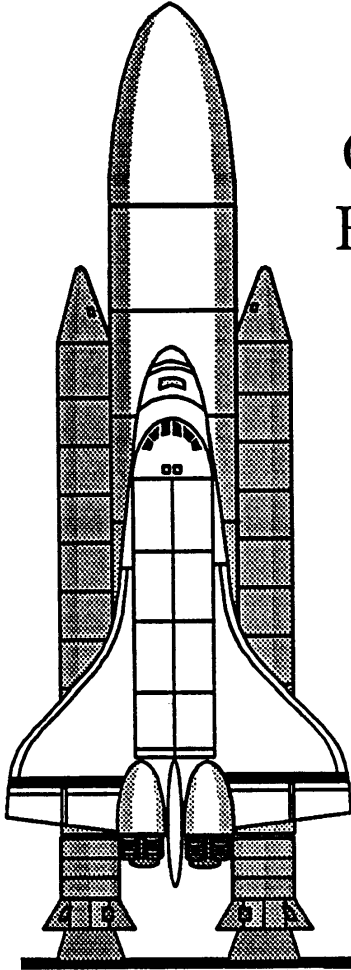
All elements of the SSP must adhere to these baselined requirements. When it is considered by the Space Shuttle program element/project managers to be in the best interest of the SSP to change, waive or deviate from these requirements, an SSP Change Request (CR) shall be submitted. United Space Alliance (USA) will process the CR and obtain System Safety Review Panel (SSRP), Integration Control Board (ICB), and Program Requirements Control Board (PRCB) approval as documented in PDP MS3-003, Product Development Plan for Cargo Safety. These control boards are responsible for identifying an acceptable resolution while satisfying the NSTS 1700.7B Paragraph 102.2 requirement. The CR must include a complete description of the change, waiver or deviation and the rationale to justify its consideration. All such requests will be processed in accordance with NSTS 07700, Volume IV – Book 1 and dispositioned by the Manager, Space Shuttle Program on a Space Shuttle PRCB Directive (PRCBD).



Tommy W. Holloway  
Manager, Space Shuttle Program



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# GENERIC INTEGRATED CARGO HAZARD ASSESSMENT REPORT (GICHAR)

## SPACE SHUTTLE

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*for Cal M. Lamm* 3/14/96  
H. F. BATTAGLIA, CHAIRMAN  
PAYLOAD SAFETY REVIEW  
PANEL

*John C. Dollberg* 3/17/96  
J. DOLLBERG, CHAIRMAN  
PAYLOAD GROUND SAFETY  
REVIEW PANEL

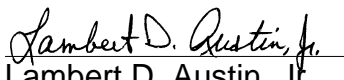
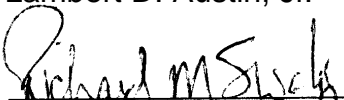

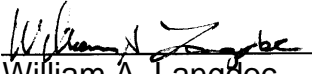

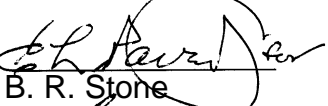


*D. W. Whittle*  
D. W. WHITTLE, CHAIRMAN  
SYSTEM SAFETY REVIEW  
PANEL

*John Swanson* 3/11/96  
J. SWANSON, CHAIRMAN  
INTEGRATION CONTROL BOARD  
FOR INTEGRATION SAFETY

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# GENERIC INTEGRATED CARGO HAZARD ASSESSMENT REPORT APPROVAL SHEET

The signatures of the organizations below signify concurrence and approval of the Generic Integrated Cargo Hazard Assessment and Accountability Process. In addition, the undersigned organizations concur with the documentation of Integrated Cargo Hazard Control accountability and will document their mission by mission compliance through their Certificate of Flight Readiness for all hazard controls verifications for which their organization has the responsibility for completion as documented in the Appendix A.

<u>Organization</u>	<u>Mail Code</u>	<u>Responsible Representatives</u>
Systems and Cargo Engineering Office	MS	 Lambert D. Austin, Jr.
Customer and Flight Integration Office	MT	 Richard Swalin
Earth Science and Solar System Exploration Division	SN	 Douglas P. Blanchard, Ph.D.
Flight Crew Support Division	SP	 William A. Langdoc
Medical Sciences Division	SD	 for Sam L. Pool, M.D.
Mission Operations Directorate	DA	 B. R. Stone
Manufacturing, Materials, and Process Technology Division	EM	 Frank J. Benz
Director, Safety and Reliability	KSC-RT	 Joel R. Reynolds

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## ABSTRACT

Rockwell International prepared the GICHAR under the guidance and direction of the Systems and Cargo Engineering Office at the Lyndon B. Johnson Space Center (JSC), Houston, Texas. The assessment addresses generic hazards involved with the cargo integration ground process, and during flight. The assessment validates the cargo mix, the Orbiter interfaces, and cargo crew operations for all Shuttle missions.

Twenty-five Generic Integrated Cargo Hazard Reports (GICHRs) are baselined. JSC Engineering and Operations organizations and the Kennedy Space Center (KSC) safety organization reviewed these hazard reports for concurrence. The following is a list of the hazard reports:

GICHR	Title
001	Premature/Inadvertent Cargo Element(s) Hazardous Operations (Flight)
002	Flammable Materials and Flame Propagation Paths (Flight)
003	Cargo Elements Degrade Orbiter Critical Functions (Flight)
004	Excessive Ionizing Radiation (Flight)
005	Excessive Radiated Non-Ionizing Emissions (Flight)
006	Excessive Conducted Emissions (Flight)
007	Structural Failure (Flight)
008	Collision/Contact Payload to Payload or Payload to Orbiter (Flight)
009	EVA Operations Hazards (Flight)
010	Cargo Element Temperature Extremes (Flight)
011	Cargo Element and Orbiter Incompatible Operations (Flight)
012	Structural Damage to Payloads (Flight)
013	Safety Critical Functions Fail to Operate (Flight)
014	Failure to Maintain a Hazard Free Crew Environment (Flight)
015	Loss of Entry Capability (Flight)
016	Structural Failure of Support Structures and Handling Equipment (Ground)
017	Collision During Handling (Ground)
018	Inadvertent Release of Corrosive, Toxic, Flammable, or Cryogenic Fluids (Ground)
019	Loss of Habitable/Breathable Atmosphere (Ground)
020	Inadvertent Activation of Hazardous Ordnance Devices (Ground)
021	Ignition of Flammable Atmosphere/Material (Ground)
022	Electrical Shock/Burns (Ground)
023	Personnel Exposure to Excessive Levels of Ionizing or NonIonizing Radiation (Ground)
024	Use of Hazardous/Incompatible GSE Materials (Ground)
025	Inadvertent Deployment of Appendages (Ground)

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# ***CONTENTS***

*NSTS 21111*

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<b>1.0</b>	<b>PURPOSE .....</b>	<b>1–1</b>
<b>1.2</b>	<b>BACKGROUND .....</b>	<b>1–1</b>
<b>1.3</b>	<b>SCOPE .....</b>	<b>1–1</b>
<b>2.0</b>	<b>APPLICABLE DOCUMENTS .....</b>	<b>2–1</b>
<b>3.0</b>	<b>INTEGRATED CARGO GENERIC HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS .....</b>	<b>3–1</b>
<b>3.1</b>	<b>SUMMARY OF THE GENERIC INTEGRATED CARGO HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS ...</b>	<b>3–1</b>
<b>3.2</b>	<b>TOP LEVEL OVERSIGHT FUNCTION .....</b>	<b>3–1</b>
<b>3.3</b>	<b>AUDIT FUNCTION .....</b>	<b>3–2</b>
<b>3.4</b>	<b>ACCOUNTABILITY .....</b>	<b>3–2</b>
<b>4.0</b>	<b>GENERIC INTEGRATED CARGO HAZARD REPORTS .....</b>	<b>4–1</b>
<b>4.1</b>	<b>SUMMARY OF GENERIC INTEGRATED CARGO HAZARD REPORTS .....</b>	<b>4–2</b>



# *APPENDICES*

## *NSTS 21111*

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A	GENERIC INTEGRATED CARGO HAZARD REPORT ACCOUNTABILITY MATRIX .....	A-1
B	GENERIC INTEGRATED CARGO HAZARD TASK COORDINATION MATRIX .....	B-1
C	GENERIC INTEGRATED CARGO HAZARD ORGANIZATION POINT OF CONTACT IDENTIFICATION .....	C-1
D	ACRONYMS .....	D-1

***TABLES***

***NSTS 21111***

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4.1        GENERIC INTEGRATED CARGO HAZARD REPORTS ..... 4–9

# ***FIGURES***

***NSTS 21111***

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3.1	GENERIC INTEGRATED CARGO HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS .....	3-1
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## **1.0 PURPOSE**

This report is a non-flight specific cargo integration hazard assessment report developed to verify implementation of hazard controls to support safety of flight certification and Payload Readiness Review (PRR). In addition, this report documents organizational accountability for the integrated hazard controls.

## **1.2 BACKGROUND**

The return to flight with STS-26 in 1988 generated a requirement to certify that potential cargo integration hazards had been identified, their controls documented, and verification completed for all flight elements. Payloads provided their safety data packages for review and approval, and an integrated cargo hazard assessment was performed through the Integrated Cargo Hazard Assessment Report (ICHAR) process. The ICHAR provided a document which verified potential flight and ground hazard control implementation for the integrated cargo mix hazards associated with a particular mission.

A succession of completed ICHARs identified that each flight had similar potential hazards and controls. These similarities resulted in an ICHAR hazard report baseline with the applicable controls and verifications incorporated for each mission.

An ICHAR evaluation identified that the process may duplicate part of the Certificate of Flight Readiness (CoFR) methodology. Responsible organizations certify performance of all work required for flight prior to launch. Program cargo integration assessments and engineering analyses (i.e. thermal, structural, crew procedures, etc.) provide identified cargo integration hazard controls and verifications. A generic ICHAR with generic hazard reports identifying the potential hazards and responsible organizations assess the hazard controls, eliminates possible effort duplication.

Previous ICHARs incorporated all verification data documenting hazard report closure, and summarized the assessment results. The Generic Integrated Cargo Hazard Assessment Report (GICHAR) identifies the responsible task verification organizations which report the task completion in their CoFR statements. This document is the culmination of that effort, and defines the process by which verification of closure of potential hazards associated with each flight is performed and documented.

## **1.3 SCOPE**

This document identifies NASA JSC functional organizations responsible for the performance of potential hazard assessment and verification of hazard control implementation to assure certification of safety for flight for each Space Shuttle Program (SSP) mission.

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## 2.0 APPLICABLE DOCUMENTS

The following documents of the date and issue shown form a part of this document to the extent specified herein. “(Current Issue)” is shown in place of a specific date and issue when the document is under Space Shuttle PRCB control. The current status of documents shown with “(Current Issue)” may be determined from NSTS 08102, Program Document Description and Status Report.

NSTS 07700,  
Volume X  
(Current Issue)

Space Shuttle Flight and Ground System  
Specifications

Ref. Para. 4.0, Apx. B

NSTS 07700,  
Volume XIV  
(Current Issue)

Space Shuttle System Payload Accommodations

Ref. Table 4.1

NSTS 08080–1  
(Current Issue)

Space Shuttle Manned Spacecraft Criteria and  
Standards

Ref. Table 4.1

NSTS 08171  
(Current Issue)

Operations and Maintenance Requirements and  
Specifications Document

Ref. Para. Table 4.1, Apx. B

NSTS 16979  
(July 2, 1991)

Shuttle Orbiter Failure Modes and Fault  
Tolerances for Interfaces and Services

Ref. Table 4.1

NSTS 1700.7B  
(January 1989)

Safety Policy and Requirements for Payloads  
Using the Space Transportation System

Ref. Table 4.1

ICD-2-19001  
(Current Issue)

Shuttle Orbiter/Cargo Standard Interface  
Control Document

Ref. Para. 4.0, Apx. B, Table 4.1

JSC 17481A  
(September 28, 1984)

Safety Requirements Document for JSC Space  
Shuttle Flight Equipment

Ref. Table 4.1

KHB 1700.7B  
(September 1, 1992)

Space Transportation System Payload Ground  
Safety Handbook

Ref. Table 4.1

KHB 1860.2  
(June 30, 1993)

Ionization Radiation Protection

Ref. Table 4.1, Apx. B

MIL-STD-1512  
(March 21, 1972)

Electroexplosive Subsystems Electrically Initiated  
Design Requirement and Test Methods

Ref. Table 4.1

MIL-STD-1576  
(September 4, 1992)

Electroexplosive Subsystem Safety Requirements  
and Test Methods for Space System

Ref. Table 4.1

PDP MS3-003

Product Development Plan for Cargo Safety

Ref. Foreword

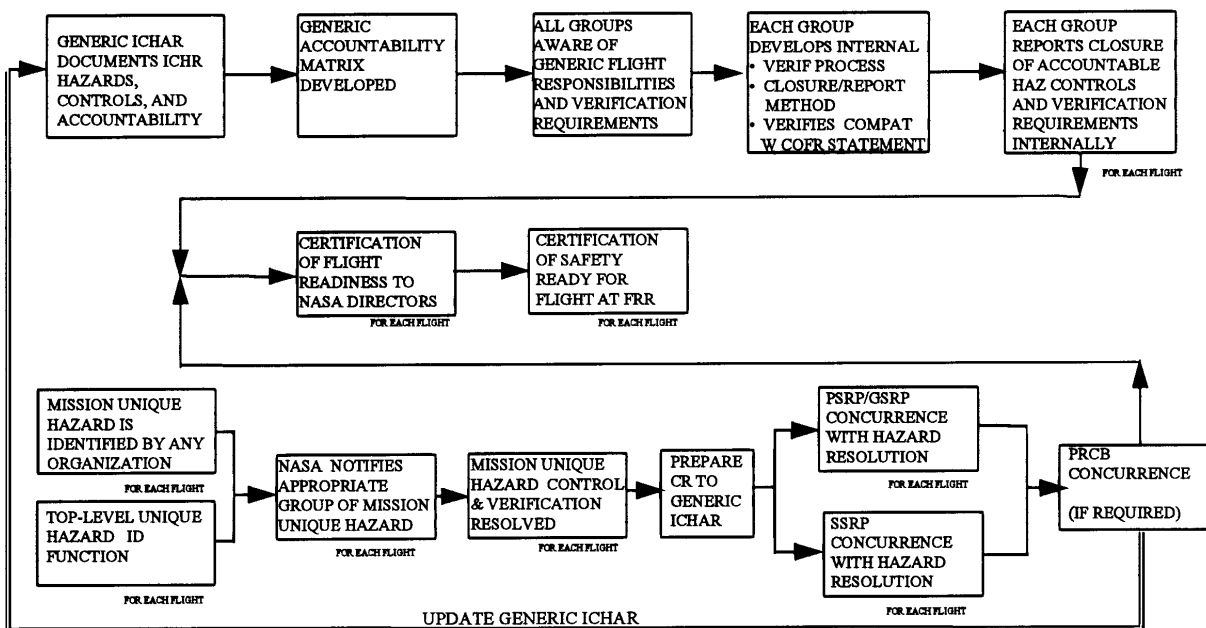
### 3.0 INTEGRATED CARGO GENERIC HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS

#### 3.1 SUMMARY OF THE GENERIC INTEGRATED CARGO HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS

The following process ensures that responsible organizations address hazard control and hazard control verification. This process addresses both generic hazards common to all SSP missions, and unique hazards resulting from a unique payload or integrated cargo requirement/design. The process results are documented as a part of CoFR and Certification for Ready for Flight.

**FIGURE 3.1**

#### GENERIC INTEGRATED CARGO HAZARD ASSESSMENT AND ACCOUNTABILITY PROCESS



As noted in the above figure, there are separate paths for generic and flight-unique hazards. However, hazard control verification of both become part of the CoFR and Certification of Safety Ready for Flight process. JSC and KSC will follow the same process, however KSC will present their findings to the PRR prior to payload installation.

#### 3.2 TOP LEVEL OVERSIGHT FUNCTION

United Space Alliance (USA) D7003 will perform a top level oversight function to identify if a new unique hazard, which falls outside of the generic hazards, exists. The Payload and Industrial Safety Division will likewise perform an analysis of the KSC



cargo integration operations to see if any new unique hazards exist. These reviews will be accomplished for each mission and any new unique hazards will be documented and presented to the System Safety Review Panel (SSRP) by the respective organization.

### **3.3 AUDIT FUNCTION**

The Payload and Crew Equipment Branch and the Payload and Industrial Safety Division will periodically perform audits to assure the rigor of evaluation as required by the SSRP and the CoFR process is being maintained.

### **3.4 ACCOUNTABILITY**

The office of primary responsibility for this document is USA D7003.

Each organization required to perform a verification(s) will report closure as part of their CoFR statement. For ground hazards, the organization(s) required to perform a verification(s) will report closure as part of their readiness statement, given at the Payload Readiness Review (PRR), prior to the installation of cargo element(s) into the Orbiter. Use of the standard generic hazard reports and accountability matrix will provide a consistent set of integrated analysis for cargo integration/operation.

The SSRP is responsible for identifying and controlling the risk the SSP is willing to accept.

#### 4.0 GENERIC INTEGRATED CARGO HAZARD REPORTS

Twenty-five GICHRs have been baselined. The following baselined hazard reports are documented in this section:

GICHR	Title
001	Premature/Inadvertent Cargo Element(s) Hazardous Operations (Flight)
002	Flammable Materials and Flame Propagation Paths (Flight)
003	Cargo Elements Degrade Orbiter Critical Functions (Flight)
004	Excessive Ionizing Radiation (Flight)
005	Excessive Radiated Non-Ionizing Emissions (Flight)
006	Excessive Conducted Emissions (Flight)
007	Structural Failure (Flight)
008	Collision/Contact Payload to Payload or Payload to Orbiter (Flight)
009	EVA Operations Hazards (Flight)
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023	Personnel Exposure to Excessive Levels of Ionizing or Non-Ionizing Radiation (Ground)
024	Use of Hazardous/Incompatible GSE Materials (Ground)
025	Inadvertent Deployment of Appendages (Ground)

Flight specific evaluations identified in these hazard reports as Verification Task are mission specific and must be accomplished for each flight. The PRR and CoFR statements will document the responsible organization's compliance with the applicable safety requirements listed with each verification task listed in this document.

## **4.1 SUMMARY OF GENERIC INTEGRATED CARGO HAZARD REPORTS**

### **GICHR–001 – Premature/Inadvertent Cargo Element(s) Hazardous Operations (Appendage Deployment, Separation/Deployment, Etc.) (Flight)**

This hazard deals with the inability to maintain fault tolerance through implementation of Orbiter services, including shared services, required by cargo element(s) for hazard control/monitoring. No inappropriate assignments of Orbiter power sources to cargo elements were identified which could reduce hazard control fault tolerance to cause premature/inadvertent hazardous operations. Electrical functionality is implemented to maintain cargo element fault tolerance as identified per the unique payload/Orbiter Interface Control Documents (ICDs), Payload Integration Plan (PIPs), and Interface Definition Documents (IDDs) as appropriate. The payload operating procedures are developed to preclude conflict of operations while continuing to meet fault tolerance requirements.

### **GICHR–002 – Flammable/Corrosive Materials and Flame Propagation Paths (Flight)**

This hazard is concerned with the incompatibility of integrated cargo elements, materials, fluids and/or design with each other and cumulatively with the Orbiter, leading to fire/explosion. Materials used on the payloads and integration hardware do not present flame propagation paths between the payloads and the Orbiter. Venting or leakage of contained gases or fluids will not create a flammable condition.

### **GICHR–003 – Cargo Elements Degrade Orbiter Critical Functions (Flight)**

This hazard deals with the cargo elements cumulative power usage or failures creating excessive power usage which degrade operation of Orbiter critical functions during ascent. The ascent power analysis verifies adequate Fuel Cell Performance (FCP) margins to provide sufficient power to operate the Solid Rocket Booster (SRB) avionics with one fuel cell failed. A generic worst case Spacecraft Electrical Power Simulation (SEPS) run determined the maximum power that the Orbiter can provide to a failed-on payload during ascent and still have adequate power to operate the Orbiter systems is 5200 watts with three good fuel cells. The worst case payload is within this power range.

### **GICHR–004 – Excessive Ionizing Radiation (Flight)**

This hazard deals with cumulative ionizing radiation from cargo elements leading to a hazardous condition in other cargo elements, the Orbiter or the crew. The cumulative ionizing radiation levels are limited to prevent a hazardous condition to the payload/Orbiter/crew.

### **GICHR-005 – Excessive Radiated Non-Ionizing Emissions (Flight)**

This hazard concerns cargo elements combined radiated non-ionizing emissions creating a hazardous condition in one or more cargo element and/or the Orbiter avionics/circuitry or Extravehicular Activity (EVA) and non-EVA crew members. The Radio Frequency (RF) emissions of the cargo elements are compatible with each other, the Orbiter, and the crew and the radiated intensities meet the requirements of the ICD-2-19001, Shuttle Orbiter/Cargo Standard Interface Control Document and/or the appropriate IDD/ICDs with approved exceedances.

### **GICHR-006 – Excessive Conducted Emissions (Flight)**

This hazard deals with the cargo elements cumulative conducted emissions creating a hazardous condition in one or more cargo elements and/or causing interference to Orbiter circuits. The allowable conducted emissions of the cargo elements are compatible with each other's radiated susceptibility thresholds of the Orbiter and the crew, and meet the requirements of the ICD-2-19001 and/or the appropriate IDD/ICDs with approved exceedances. Additionally, this hazard deals with the proper bonding of equipment for RF fault and static bonding, including the cargo element's thermal blankets.

### **GICHR-007 – Structural Failure (Flight)**

This hazard deals with integrated cargo elements cumulative loads or with Payload Bay (PLB) vent blockage causing structural failure. The Orbiter loads analysis verifies a positive margin of safety for integration hardware. The Orbiter end-of-mission landing weight is within the Orbiter load-carrying capability as defined in the NSTS 07700, Volume X, Space Shuttle Flight and Ground System Specifications. The mid-deck payload weight and Center of Gravity (CG) are within the Orbiter and mid-deck ICD limits. The interface loads between the Orbiter and the payloads are within the Orbiter capability. The results of the vent blockage assessment with respect to Orbiter over-pressure limits determined that over-pressure of the PLB is not a concern.

### **GICHR-008 – Collision/Contact Payload to Payload or Payload to Orbiter (Flight)**

This hazard deals with collision or contact of cargo elements with one another and/or the Orbiter. Cargo element and hardware installation technical orders contain properly coded critical installation sequences/requirements. The relative deflections between the cargo elements and the Orbiter were verified to maintain positive clearances. Orbiter payload nominal and off-nominal operations for deployment, rendezvous, retrieval, and restowing are developed to prevent collision with the Orbiter and payloads. Out the window visual cues and/or telemetry, with or without PLB Closed Circuit Television (CCTV) views, are sufficient to control hazardous operations being performed in the PLB.

### **GICHR-009 – EVA Operations Hazards (Flight)**

This hazard is concerned with the cargo element mix in the PLB presenting contact hazards to the EVA crew. The design of EVA translation paths and worksites are evaluated and verified at JSC as part of the crew training. EVA translation paths and worksites are designed to preclude the EVA crew members from entering areas where radiation sources cannot be inhibited. The EVA crew is trained for keepout zones and avoidance distances from potential cargo element areas to prevent contamination of the Extravehicular Mobility Unit (EMU) and contact with moving flight hardware in the event of inadvertent operation of payload or Orbiter appendages and/or equipment. EVA crew members are trained in the proper tether protocol. Safety certification of flight specific EVA operations is provided by a Flight Techniques Panel and documented in the meeting minutes.

### **GICHR-010 – Cargo Element Temperature Extremes (Flight)**

This hazard deals with temperature extremes created by the cargo mix placement or operational requirement incompatibilities. The integrated thermal assessment has verified thermal compatibility of Payload Integration Hardware (PIH) and cargo elements with the Orbiter and with each other.

### **GICHR-011 – Cargo Element(s) and Orbiter Incompatible Operations (Flight)**

This hazard deals with cargo element and/or Orbiter nominal and contingency operational incompatibilities which lead to a hazardous condition. Critical mission sequences and specific flight rules are developed to preclude any conflict of operations between payloads and/or with the Orbiter while continuing to meet fault tolerance requirements. An independent operational hazard controls safety verification report ensures that the required hazard controls are incorporated into the proper procedures or flight rules.

### **GICHR-012 – Structural Damage to Payloads (Flight)**

This hazard is concerned with a PLB vent door remaining open during entry, resulting in elevated temperatures affecting returning integration hardware and non-deployable payloads and payload equipment. Thermal assessment shows that payload integration hardware located within the predicted heating envelope of the failed PLB vent door is not adversely affected by the predicted thermal environment. Thermal assessment shows that cargo elements located within the predicted heating envelope of a failed PLB vent door meet the requirements of ICD-2-19001.

### **GICHR-013 – Safety Critical Functions Fail to Operate (Flight)**

This hazard deals with the inability to maintain fault tolerances through implementation of Orbiter services, including shared services, required by cargo element(s). No inappropriate assignments of redundant Orbiter power sources, must work functions, or

other payload redundancy paths were identified which could reduce hazard control fault tolerance, causing safety-critical functions to fail to operate. Electrical functionality is implemented to maintain cargo element fault tolerance as identified per the unique payload/Orbiter ICDs, PIPs, and IDD as appropriate. The appropriate crew procedures and flight rules are verified.

#### **GICHR-014 – Failure to Maintain a Hazard Free Crew Environment (Flight)**

This hazard is concerned with the potential hazards to the crew while within the Intravehicular Activity (IVA) environment of the crew cabin, and other crew-habitable modules. These hazards include:

Cumulative offgassing of toxic materials in the crew cabin which injures or incapacitates the crew resulting in injury/death of crew. Material analysis and testing, as applicable, determines toxic emissions for payload integration hardware and each cargo element. The JSC toxicologist determined that the expected cumulative toxic emissions are within acceptable limits.

Improper equipment design or in-flight maintenance procedures expose the crew to electrical shock or unplanned cargo element operation. Electrical shock and inadvertent operational hazards during in-flight maintenance are controlled through powerdown procedures prior to crew interface. All approved in-flight maintenance procedures contain measures to prevent unintentional electrical grounding, inadvertent operations and accidental electrical shock when a hazard potential exists.

Surface temperatures outside touch temperature limits. Thermal interactions between mid-deck payloads or between mid-deck payloads and the Orbiter do not result in crew accessible surfaces exceeding touch temperature limits.

Inadequate or incompatible procedures, IVA tools and/or IVA training. IVA worksites, interfaces and procedures were tested and checked out at JSC with flight hardware and training mockups. The flight crew was specifically trained for safety critical IVA scenarios documented in payload hazard reports.

#### **GICHR-015 – Loss of Entry Capability (Flight)**

This hazard report addresses the inability to cumulatively safe cargo elements for contingency return which results in injury/death of crew and/or damage/loss of Orbiter. The cargo bay payloads clear the PLB moldline within 20 minutes. The Payload Bay Doors (PLBDs) can be closed to support deorbit burn within 30 minutes of declaration of emergency. The mid-deck payloads, Detailed Supplementary Objectives (DSOs), and Detailed Test Objectives (DTOs) do not prevent or delay a contingency return of the Orbiter. They can be cumulatively safed/stowed within 60 minutes. Crew habitable payloads do not delay or prevent a contingency return of the Orbiter. They can be cumulatively safed/stowed within allowable time constraints.

It also addresses shrapnel from the crew escape system decompression panel vent severance assembly at the X<sub>0</sub> 576 bulkhead can penetrate integration hardware or payloads resulting in a fire/explosion or inadvertent operation before the crew can safely escape the Orbiter in an emergency. Cargo element analysis on the effect of shrapnel penetration demonstrates that a hazardous condition will not exist which could lead to fire/explosion prior to crew escape. In addition, analysis indicates that shorting of the wire harnesses which contain safety-critical circuits will not cause catastrophic damage to the Orbiter side of the interface prior to crew bailout. Analysis of payload safety critical circuits demonstrates that no hazardous condition (e.g., explosion, shift of CG, etc.) will arise which will affect the stable gliding flight of the Orbiter which is necessary for crew bailout.

#### **GICHR-016 – Structural Failure of Support Structures and Handling Equipment (Ground)**

This hazard report addresses structural failure of support structures and handling equipment due to imposing loads which exceed the design strength of the structures and handling equipment or the use of defective materials or inadequate manufacturing procedures.

#### **GICHR-017 – Collision During Handling (Ground)**

This hazard report addresses collision of Flight Hardware, Ground Support Equipment (GSE) and personnel due to human error, inadequate safety features and inadequate clearances.

#### **GICHR-018 – Inadvertent Release of Corrosive, Toxic, Flammable, or Cryogenic Fluids (Ground)**

This hazard report addresses inadvertent release of corrosive, toxic, flammable, or cryogenic fluids due to GSE failures, human errors and/or elevated thermal conditions.

#### **GICHR-019 – Loss of Habitable/Breathable Atmosphere (Ground)**

This hazard report addresses loss of habitable/breathable atmosphere due to accumulative offgassing from materials or due to the lack of oxygen.

#### **GICHR-020 – Inadvertent Activation of Hazardous Ordnance Devices (Ground)**

This hazard report addresses the inadvertent activation of hazardous ordnance devices due to improper installation, checkout, or failure of electrical circuitry. Also, this hazard addresses inadvertent activation due to electrostatic discharge.

#### **GICHR-021 – Ignition of Flammable Atmosphere/Material (Ground)**

This hazard report addresses ignition of flammable atmosphere/materials due to improper use of flammable materials near credible ignition sources in the presence of hot temperature surfaces or near devices which may produce arcing or sparking.

### **GICHR-022 – Electrical Shock/Burns (Ground)**

This hazard report addresses electrical shock/burns due to unguarded power supplies or due to mismatching of connectors.

### **GICHR-023 – Personnel Exposure to Excessive Levels of Ionizing or Non-Ionizing Radiation (Ground)**

This hazard report addresses personnel exposure to excessive levels of ionizing or non-ionizing radiation due to accumulative hazardous levels of ionizing radiation and/or non-ionizing radiation.

### **GICHR-024 – Use of Hazardous/Incompatible GSE Materials (Ground)**

This hazard report addresses the use of hazardous/incompatible GSE materials of the different cargo elements (one to another).

### **GICHR-025 – Inadvertent Deployment of Appendages (Ground)**

This hazard report addresses the inadvertent deployment of appendages due to electrical failure of appendage deployment circuitry, inadvertent issuance of commands, and/or improper use of GSE during verification and checkout of the spacecraft.



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**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS**

<b>MISSION:</b> STS–GENERIC	<b>GICHR NO:</b> 001			<b>DATE:</b> Feb. 1, 1995
<b>FLIGHT PHASE:</b> All	<b>HAZARD GROUP:</b> Collision/Fire/Explosion/Injury		<b>VERSION:</b> Baseline	
<b>HAZARD TITLE:</b> Premature/inadvertent cargo element(s) hazardous operations (appendage deployment, separation/deployment, etc.)			<b>CATEGORY:</b> <b>CATASTROPHIC (X)</b> <b>CRITICAL ( )</b>	
<b>HAZARD DESCRIPTION:</b> Inability to maintain fault tolerance through implementation of Orbiter services, including shared services, required by cargo element(s) for hazard control/monitoring results in injury/death of crew or damage/loss of Orbiter due to premature or inadvertent cargo element(s) operation.				
<b>APPLICABLE SAFETY REQUIREMENTS:</b> Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"> <li>– Para. 102.2    Responsibility – NSTS</li> <li>– Para. 201.2    Failure Tolerance – Catastrophic Hazards</li> <li>– Para. 206      Failure Propagation</li> </ul> Payload Integration Hardware Requirements: JSC 17481A <ul style="list-style-type: none"> <li>– Para. 5.1      Failure Tolerance</li> <li>– Para. 5.4      Failure Propagation</li> </ul> NSTS 08080–1 <ul style="list-style-type: none"> <li>– STD–4          Separation of Redundant Equipment</li> <li>– STD–20        Redundant Electrical Circuits</li> <li>– STD–32        Pin Assignment</li> </ul> Level II PRCBD S41328, waiver to NSTS 08080–1 wiring standards 4B, 20A, and 32 for payload interfaces. Standards 4B, 20A, and 32 of the earlier version of NSTS 08080–1 are equivalent to B5 and G2 of NSTS 08080–1, 4/1/91. NSTS 16979 Shuttle Orbiter Failure Modes and Fault Tolerances for Interfaces and Services Defined in ICD–2–19001.				
<b>HAZARD CAUSE:</b>	<b>HAZARD CONTROL:</b>	<b>VERIFICATION TASK</b>		<b>RESPONSIBLE VERIFICATION ORGANIZATION</b>
01 Inappropriate assignment of Orbiter power sources to cargo elements for maintaining hazard control fault tolerance.	0101 No identified inappropriate assignments of Orbiter power sources to cargo elements which can reduce hazard control fault tolerance to cause premature/inadvertent hazardous operations.	USA D7003: Assess flight requirements, ICDs, IDD, PIPs, payload safety data packages, Failure Modes and Fault Tolerance Document, etc., and the Flight Integrated Schematic to assure no conflict of power assignments that reduce required hazard control fault tolerance.		010101 USA D7003

NSTS 21111  
Baseline

4–9

CHANGE NO. 1

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC	GICHR NO: 001		DATE: Feb. 1, 1995
<p>02</p> <p>Faults in Orbiter electrical services reduce cargo element fault tolerances levels below those provided in the ICD and PIP.</p> <ul style="list-style-type: none"> <li>– inadvertent loss of respirable atmosphere within external cargo element habitable volume</li> <li>– inadvertent introduction of hazardous atmosphere within external cargo element habitable volume</li> <li>– inadvertent cargo element appendage deployment</li> <li>– inadvertent payload deployment/release</li> <li>– inadvertent cargo element safety critical operation/function</li> </ul>	<p>0201</p> <p>Electrical functionality is implemented to maintain cargo element fault tolerance as identified per the unique payload/Orbiter ICDs, PIPs, and IDD as appropriate. The appropriate crew procedures and flight rules have been verified.</p>	<p>USA D7003: Assess flight products, related Failure Modes and Effects Analysis (FMEA)/Critical Items Lists (CILs), payload safety data packages, Failure Modes and Fault Tolerance Documents, Flight Integrated Schematic, and perform bent pin analysis to assure fault tolerance is maintained to prevent inadvertent or premature hazardous events. Evaluate appropriate Operations and Maintenance Requirements and Specifications Documents (OMRSDs)/ Operations and Maintenance Instructions (OMIs) to assure pre-mate and/or postmate verification of functionality for control of inadvertent or premature hazardous events.</p> <p>JSC/DO12: Verification of Flight Data File for positioning and operation of crew cabin switches to prevent inadvertent or premature occurrence of hazardous events.</p>	<p>020101 USA D7003</p> <p>020102 JSC/Operations Division/DO</p>
<p>03</p> <p>Improper use of Orbiter services for hazard control/monitoring through procedure implementation reduces or bypasses established fault tolerance.</p>	<p>0301</p> <p>The payload operating procedures are developed to preclude any conflict of operations between cargo elements and/or the Orbiter while continuing to meet fault tolerance requirements.</p>	<p>JSC/DO12: Review of integrated payload operating procedures with customer at Flight Operations Review (FOR) to assure no conflict of operations with the Orbiter or other payloads results in an inadvertent or premature hazardous event.</p> <p>JSC/DO12: Review and completion of integrated training to ensure crew is properly trained to perform safety critical functions.</p>	<p>030101 JSC/Operations Division/DO</p> <p>030102 JSC/Operations Division/DO</p>

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 002		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Fire/Explosion			VERSION: Baseline
HAZARD TITLE: Flammable Materials and Flame Propagation Paths				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Incompatibility of PLB integrated cargo element materials and fluids with each other and cumulatively with the Orbiter lead to fire/explosion that result in injury/death of crew and/or damage/loss of Orbiter					
APPLICABLE SAFETY REQUIREMENTS: Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"><li>– Para. 102.2 Responsibility – NSTS</li><li>– Para. 206 Failure Propagation</li><li>– Para. 209.1 Hazardous Materials</li><li>– Para. 209.2 Flammable Materials</li><li>– Para. 219 Flammable Atmospheres</li></ul> Payload Integration Hardware Requirements: JSC 17481A <ul style="list-style-type: none"><li>– Para. 5.1a Catastrophic Hazards</li><li>– Para. 5.4 Failure Propagation</li><li>– Para. 5.10c Flammable Materials</li></ul>					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
RESPONSIBLE VERIFICATION ORGANIZATION					
01 The integrated cargo mix introduces flame propagation paths between the payloads and from the payloads to the Orbiter.		0101 The materials used in the cargo elements and PIH do not create flame propagation paths to the Orbiter or other payloads.		JSC/EM2: Assess PIH Material Analysis, Tracking and Control (MATCO) Report and payload flammability assessments to assure no cumulative flame propagation paths exist between the cargo elements and cargo elements and the Orbiter.	
02 The integrated cargo vent/leak products create a flammable hazard.		0201 Venting or leakage of contained gases or fluids will not create a flammable condition.		JSC/EM2: Assess cargo elements for planned venting and cumulative effects to assure no adverse reactions that create a hazard to the Orbiter. (i.e. Ignition)	
				020101 JSC/Manufacturing, Materials, and Process Technology Division/EM	

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 003		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ascent		HAZARD GROUP: Collision			VERSION: Baseline
HAZARD TITLE: Cargo elements degrade Orbiter critical functions				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Cargo elements cumulative power usage or failure creates excessive power usage degrading operation of Orbiter critical functions resulting in loss of crew and Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 213      Electrical Systems					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Excessive nominal power consumption by cargo elements prevent operation of Orbiter critical functions during ascent. Launching with a FPC less than Launch Commit Criteria (LCC) requirements (with one fuel cell failed) does not provide sufficient power to operate the SRB avionics.		0101 Ascent power analysis verifies adequate FCP margins to provide sufficient power to operate the Solid Rocket Booster avionics with one fuel cell failed.		USA D7003: Assess STS–XX Fuel Cell I–V Performance Predictions, Shuttle Operational Data Submittal WC–R–XXX–XX, for performance margins to support ascent safety requirements.	010101 USA D7003
02 Excessive power consumption due to inadvertent draw of maximum nominal power from the primary payload power bus by the payload during ascent.		0201 A generic worst case SEPS run determined the maximum power that the Orbiter can provide to a failed–on payload during ascent and still have adequate power to operate the Orbiter systems is 5200 watts with three good fuel cells. The worst case payload is within this power range.		USA D7003: Determine worst case credible spacecraft on–orbit power whose inadvertent draw during ascent may create a hazard to the Orbiter and ensure that adequate performance margins exist to support ascent safety requirements.	020101 USA D7003

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS—GENERIC	GICHR NO: 004		DATE: Feb. 1, 1995
FLIGHT PHASE: All	HAZARD GROUP: Radiation		VERSION: Baseline
HAZARD TITLE: Excessive ionizing radiation		CATEGORY: CATASTROPHIC ( )      CRITICAL (X)	
HAZARD DESCRIPTION: Cumulative ionizing radiation exposure from cargo elements leads to a hazardous condition in other cargo elements, the Orbiter or crew, resulting in injury/death of crew and/or damage/loss of the Orbiter			
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7 B – Para. 102.2    Responsibility NSTS – Para. 212.2    Ionizing Radiation			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Cumulative ionizing radiation from one or more cargo elements creates a hazardous condition to the crew members, Orbiter, or other onboard equipment.	0101 The cumulative ionizing radiation levels is limited to prevent a hazardous condition in payloads/Orbiter which results in injuries/death to the crew.	JSC/SN3: Review cumulative effect of ionizing radiation from cargo elements to determine hazardous condition to other cargo elements, the Orbiter, and to crew members in the habitable volume.	010101 JSC/Space and Life Sciences Group/SN

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 005		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Radiation			VERSION: Baseline
HAZARD TITLE: Excessive radiated non–ionizing emission				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Cargo elements cumulative radiated non–ionizing emissions create a hazardous condition in one or more cargo elements and/or the Orbiter avionics/circuitry resulting in injury/death to the crew and/or damage/loss of Orbiter					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 212.2    Non–Ionizing Radiation					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Radiated non–ionizing emissions from one cargo element create a hazardous condition in other cargo elements propagating to the Orbiter.		0101 The RF emissions of cargo elements are compatible with each other, the Orbiter, and the crew and the radiated field intensities meet the requirements of core ICD–2–19001 and/or the appropriate IDDs/ICDs with approved exceedances.		USA D7003: Assess integration and payloads singular and combined non–ionizing radiation effects on other payloads to determine if hazardous conditions are created resulting in a hazardous condition to the Orbiter.	010101 USA D7003
02 Radiated non–ionizing emissions from one or more cargo elements create a hazardous condition to the Orbiter.		0201 The RF emissions of cargo elements are compatible with each other, the Orbiter, and the crew and the radiated field intensities meet the requirements of core ICD–2–19001 and/or the appropriate IDDs/ICDs with approved exceedances.		USA D7003: Assess integration and payloads singular and combined non–ionizing radiation effects on the Orbiter to assure no hazardous condition is created to the Orbiter.	020101 USA D7003
03 Radiated non–ionizing emissions from one or more cargo elements creates a hazardous condition to crew members (EVA and non–EVA).		0301 The RF emissions of cargo elements are compatible with each other, the Orbiter, and the crew and the radiated field intensities meet the requirements of core ICD–2–19001 and/or the appropriate IDDs/ICDs with approved exceedances.		USA D7003: Assess integration and payloads singular and combined non–ionizing radiation effects to assure no hazardous condition exists to IVA crewman.	030101 USA D7003

NSTS 21111  
Baseline

4–14

CHANGE NO. 1

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 006		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Radiation			VERSION: Baseline
HAZARD TITLE: Excessive conducted emissions				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Cargo elements cumulative conducted emissions create a hazardous condition in one or more cargo elements and/or causes interference to Orbiter circuits resulting in injury/death of crew and/or damage/loss of the Orbiter					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 212.2    Non–Ionizing Radiation					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Excess conducted emissions from one cargo element creates a hazardous condition in other cargo elements propagating to the Orbiter.		0101 The allowable conducted emissions (steady state ripple noise and transient spikes) of cargo elements are compatible with each other and the Orbiter, and meet the core ICD–2–19001 and/or the appropriate    IDD/ICDs with approved exceedance.		USA D7003: Assess integration and payloads singular and cumulative conducted emissions to assure no payload hazardous conditions are created that could propagate to the Orbiter.	010101 USA D7003
02 Excessive conducted emissions from one or more cargo elements create a hazardous condition to Orbiter circuitry.		0201 The allowable conducted emissions of cargo elements are compatible with each other and the Orbiter, and meet the core ICD–2–19001 and/or the appropriate    IDD/ICDs with approved exceedance.		USA D7003: Assess integration and payloads singular and cumulative conducted emissions to assure no hazardous condition is created to the Orbiter.	020101 USA D7003

NSTS 21111  
Baseline

4–15

CHANGE NO. 1



**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

<b>MISSION: STS</b> —GENERIC		<b>GICHR NO:</b> 007	<b>DATE:</b> Feb. 1, 1995	
<b>FLIGHT PHASE:</b> All		<b>HAZARD GROUP:</b> Impact/Collision		<b>VERSION:</b> Baseline
<b>HAZARD TITLE:</b> Structural Failure			<b>CATEGORY:</b> <b>CATASTROPHIC (X)</b> <b>CRITICAL ( )</b>	
<b>HAZARD DESCRIPTION:</b> Integrated cargo element coupled loads or a PLB vent blockage creates a structural failure leading to a hazardous condition resulting in injury/death of crew and/or damage/loss of the Orbiter.				
<b>APPLICABLE SAFETY REQUIREMENTS:</b> Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"><li>– Para. 102.2    Responsibility – NSTS</li><li>– Para. 201.2    Failure Tolerance – Catastrophic Hazards</li><li>– Para. 202.6    Fluid Release from a Pressurized System Inside of a Closed Volume</li><li>– Para. 208.1    Structural Design</li><li>– Para. 208.2    Emergency Landing Loads</li></ul> Payload Integration Hardware Safety Requirements JSC 17481A <ul style="list-style-type: none"><li>– Para. 5.6      Structural</li></ul>				
<b>HAZARD CAUSE:</b>	<b>HAZARD CONTROL:</b>		<b>VERIFICATION TASK</b>	<b>RESPONSIBLE VERIFICATION ORGANIZATION</b>
01 Coupled (cumulative) loads effects of the cargo elements induce structural failure of integration hardware.	0101 Orbiter loads analysis verifies a positive margin of safety for integration hardware. The Orbiter end of mission landing weight is within the Orbiter load carrying capability as defined in the NSTS 07700, Volume X.		USA D7003: Assess Verification Loads Analysis to assure Payload Integration Hardware, including latch assemblies, cumulative load maintains a positive margin of safety for all planned flight and planned contingency conditions.  USA D7003: Assess OMRSDs/OMIs to assure prelaunch inspections of the dry lube and fiberiloid liners and post-landing turnaround inspection and functional tests of latches.	010101 USA D7003  010102 USA D7003

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 007		DATE: Feb. 1, 1995
		0102 Mid–deck payload weight and CG are within the Orbiter and mid–deck ICD limits.	USA D7003: Assess Vehicle Weight Summary Statement to assure Orbiter end–of–mission landing weight is within NSTS 07700, Volume X capability. Assess mid–deck payload weights and placements to assure mid–deck payload weight and CG are within the Orbiter capability.	010201 USA D7003
		0103 The interface loads between the Orbiter and the payloads are compatible with the Orbiter capability.	USA D7003: Assess Verification Loads Analysis to assure that cumulative interface loads between the Orbiter and the payloads is compatible with the Orbiter capability including planned contingencies.	010301 USA D7003
02 Coupled (cumulative) loads effects of the cargo elements induce structural failure of the Remote Manipulator System (RMS) due to Reaction Control System (RCS) loads during worst case attitude holds or maneuvers.	0201 Payload element/RMS operations during RCS firings are within acceptable limits.		JSC/DO12: Assess RMS/Payload operations during RCS firings to ensure that the loads are within the RMS/Orbiter capability to prevent a hazardous condition.	020101 JSC/Operations Division/DO
03 Blockage of Orbiter payload vent(s) by cargo elements causes excessive differential pressures on the Orbiter structure.	0301 The results of the vent blockage assessment with respect to Orbiter over–pressure limits determined that over–pressure of the PLB is not a concern.		USA D7003: Assess PLB vent(s) blockage by cargo elements for excessive differential pressure on the Orbiter structure.	030101 USA D7003
04 Payload planned or inadvertent venting of gas causes Orbiter structural failure due to excessive pressure.	0401 The results of the entry venting analysis with respect to Orbiter over–pressure limits determined that over–pressure of the PLB is not a concern.		USA D7003: Assess cargo element(s) venting of gas for excessive differential pressure on the Orbiter structure.	040101 USA D7003

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 008		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Impact/Collision			VERSION: Baseline
HAZARD TITLE: Collision/Contact Payload–to–Payload or Payload–to–Orbiter				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Collision or contact of cargo elements to each other or to the Orbiter damages the cargo elements and/or the Orbiter resulting in injury/death to the crew and/or damage/loss of the Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 Inadequate cargo installation clearances in the Orbiter.		0101 The Cargo Element and Hardware Installation Technical Orders contain properly coded critical installation sequences/requirements. The installation clearances identified on the cargo arrangement drawing are all positive.		USA D7003: Assess flight products to assure properly coded installation sequences and positive installation clearances.	
02 Inadequate cargo element and Orbiter deflection clearances.		0201 The relative deflections between the Orbiter, and cargo elements are verified to maintain positive clearances.		USA D7003: Assess the Verification Loads Analysis to assure positive margins due to relative deflections between the Orbiter and the installed cargo element(s).	
03 Inadequate clearance between cargo elements and the Orbiter and/or payload to payload for deployment, rendezvous, retrieval or stowing.		0301 Orbiter payload nominal and off–nominal operations for deployment, rendezvous, retrieval, and stowing are developed to prevent collision with the Orbiter and payloads.		JSC/DO12: Verify that the analyses, flight procedures, and crew training provide for payload nominal and off–nominal operations in such a manner that prevents collision of the Orbiter and the payloads.	
04 Cargo element mix and placement obscures viewing of hazardous operations being performed in the PLB.		0401 Out the window visual cues and/or telemetry, with or without PLB Closed Circuit Television (CCTV) views, are sufficient to control hazardous operations being performed in the PLB.		JSC/DO12: Verify that the flight procedures and crew training assure viewing of hazardous PLB operations or provide telemetry to prevent a hazard to the Orbiter and crew.	
				040101 JSC/Operations Division/DO	

NSTS 21111  
Baseline

4–18

CHANGE NO. 1

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC		GICHR NO: 009		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Injury/Illness			VERSION: Baseline
HAZARD TITLE: EVA Operations Hazards				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: The cargo element mix in the PLB presents operations hazards to the EVA crew resulting in injury or death.					
APPLICABLE SAFETY REQUIREMENTS: Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"><li>– Para. 102.2    Responsibility – NSTS</li><li>– Para. 101      Flight Rules</li><li>– Para. 215.1   Hazardous Operations – Hazard Identification</li><li>– Para. 215.2   Exposure to Risk</li><li>– Para. 217      Extravehicular Activity</li></ul> NSTS 07700, Volume XIV, Appendix 7, System Descriptions and Design Data – Extravehicular Activity Payload Integration Hardware Requirements: JSC 17481A <ul style="list-style-type: none"><li>– Para. 5.1a    Catastrophic Hazards</li><li>– Para. 5.4      Failure Propagation</li></ul>					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 Cumulative cargo element design presents physical hazards to crew: It contains sharp edges, pinch points, or abrasive surfaces, obstructs translation paths, limits accessibility to work sites, precludes manual closure of the PLB doors, entraps EVA crew members, or prevents rapid return to Orbiter.		0101 The design of EVA translation paths and work sites are evaluated and verified at JSC as part of the crew training. 0102 The design of EVA pathways and work sites are inspected, evaluated, and visually verified at KSC by assigned crew and cognizant Mission Operations Directorate (MOD) personnel.		JSC/DO12: Verify the crew translation path(s) and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	
				010101 JSC/Operations Division/DO	

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS—GENERIC		GICHR NO: 009		DATE: Feb. 1, 1995	
02 Exposure to excessive radiation exceeds EMU thermal and/or RF limits or injures EVA crew members. Sources include thermal radiation, ionizing or non—ionizing radiation from combined cargo elements, magnetic radiation, or focused solar radiation from PLB door radiators.	0201 EVA translation paths and work sites are designed to preclude the EVA crew members from entering areas where hazardous sources cannot be inhibited. 0202 The Orbiter Ku—band obscuration mask provides a protected area over the PLB for EVA. If EVA is performed outside the protected area, procedural control of radiating entities is provided.	JSC/DO12: Verify thermal radiation keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	020101 JSC/Operations Division/DO		
03 The Orbiter or cargo elements vent or leak products which contaminate the EMU and jeopardize crew health. Sources of contamination include corrosive products from cargo elements, hot gases from an Orbiter thruster or Auxiliary Power Unit (APU) exhaust, or toxicants brought into the crew cabin from external cargo element sources.	0301 The EVA crew is trained for keepout zones and avoidance distances from potential cargo element areas to prevent contamination of the EMU. 0302 EMU cleanup and bakeout procedures are available real—time to the crew.	JSC/DO12: Verify contamination keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	030101 JSC/Operations Division/DO		
04 Premature or inadvertent cargo elements operations create a hazard to EVA crew members. Such operations include inadvertent cargo operation, release of stored energy from a payload device or EVA tool, inadvertent release of EVA tools, inadvertently detached or unrestrained equipment, excessive loads on EVA hardware.	0401 EVA work sites and translation paths are developed for potential payload operations and appropriate crew procedures are developed. 0402 EVA crew members are trained in the proper tether protocol. 0403 Realtime analysis capability is available to recommend a safe Orbiter maneuver in response to inadvertently detached equipment.	JSC/DO12: Verify stored energy keepout zone(s), tether access area(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	040101 JSC/Operations Division/DO		

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC	GICHR NO: 009		DATE: Feb. 1, 1995
<p>05 Inadequate or incompatible procedures, EVA interfaces, EVA tools or EVA training jeopardize crew. This could result in task complexity causing fatigue, inappropriate handling of large masses, improper tools provided, inadequate stowage procedures, unrestrained crew member, or EVA crew member collision with Orbiter.</p>	<p>0501 EVA work sites, interfaces and procedures are tested and checked out at JSC with flight–like hardware and training mockups.</p> <p>0502 EVA work sites and interfaces are inspected and checked with flight hardware and tools to be used.</p> <p>0503 EVA crew members are trained in the proper tether protocol.</p> <p>0504 Procedures will be provided to perform rescue/retrieval of an untethered EVA crewmember via Orbiter maneuvering and/or self–rescue hardware.</p> <p>0505 Safety certification of flight–specific EVA operations is provided by a Flight Techniques Panel and documented in the meeting minutes.</p>	<p>JSC/DO12: Verify task complexity, mass handling, fit check(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.</p>	<p>050101 JSC/Operations Division/DO</p>
<p>06 Exposure to excessive radiation disrupts EMU avionics</p>	<p>0601 EVA translation paths and work sites are designed to preclude the EVA crew members from entering areas where radiation sources cannot be inhibited.</p> <p>0602 The Orbiter Ku–band obscuration mask provides a protected area over the PLB for EVA. If EVA is performed outside the protected area, procedural control of radiating entities is provided.</p>	<p>JSC/DO12: Verify radiation source keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.</p>	<p>060101 JSC/Operations Division/DO</p>

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS—GENERIC		GICHR NO: 010		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Temperature Extremes			VERSION: Baseline
HAZARD TITLE: Cargo Element Temperature Extremes				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Temperature extremes created by the PLB cargo mix placement or operational requirement incompatibilities lead to injury/death of the crew and/or damage/loss of the Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 200.3    Environmental Compatibility					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Excessive high or low temperatures due to the cargo element mix creates a hazardous condition to the Orbiter.		0101 The integrated thermal analysis verified thermal compatibility of PIH and cargo element(s) with the Orbiter and with each other.		USA D7003: Assess the Integrated Thermal Analysis for payload mix excessive high or low temperatures and the potential for creating a hazardous condition.	010101 USA D7003

NSTS 21111  
Baseline

4-22

CHANGE NO. 1

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 011		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Collision/Injury			VERSION: Baseline
HAZARD TITLE: Cargo Element and Orbiter Incompatible Operations				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Cargo element and/or Orbiter nominal and contingency operational incompatibilities lead to a hazardous condition resulting in injury/death to the crew and/or damage/loss of the Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 101.2    Flight Rules – Para. 200.1b   Catastrophic Hazards – Para. 215.1    Hazard Identification					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 Operational procedures and flight rules conflict with each other creating a hazardous condition to the crew and/or the Orbiter.		0101 Critical mission sequences and specific flight rules are developed to preclude any conflict or operations between payloads and/or the Orbiter while continuing to meet fault tolerance requirements.		JSC/DO12: Assess cargo element and Orbiter operational procedures and flight rules to assure no conflicts of operations can lead to a hazardous condition to the Orbiter and the crew.	
02 Crew procedures and/or flight rules are inconsistent with hazard controls defined in the payload hazard reports creating a hazardous condition to the crew and/or the Orbiter.		0201 An independent operational hazard controls safety verification report ensures that the required hazard controls are incorporated into the proper procedures or flight rules.		JSC/DO12: Review operational procedures and flight rules to assure incorporation of payload–required operational hazard controls as specified in the payload(s) hazard reports.	
				020101 JSC/Operations Division/DO	



**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC		GICHR NO: 012		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Collision/Fire/Explosion			VERSION: Baseline
HAZARD TITLE: Structural Damage to Payloads				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: PLB vent door(s) remains open during entry, resulting in elevated temperature around returning cargo elements causing structural failure/collision or fire/explosion. This could result in loss of crew/or Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"><li>– Para. 102.2    Responsibility – NSTS</li><li>– Para. 200.2    Failure Tolerance – Catastrophic Hazards</li><li>– Para. 206      Failure Propagation</li><li>– Para. 208.1    Structural Design</li><li>– Para. 208.2    Emergency Landing Loads</li><li>– Para. 209.1    Hazard Materials</li><li>– Para. 209.2    Flammable Materials</li></ul>					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 PLB vent door(s) fails open exposing the payload integration hardware or cargo elements to a hazardous thermal environment. This would result in a catastrophic event to the Orbiter.		0101 Thermal assessment shows that PIH located within the predicted heating envelope of a failed PLB vent door is not adversely affected by the predicted thermal environment.		USA D7003: Assess thermal analysis performed on impact to PIH for a failed open PLBD to assure no hazardous condition created to the Orbiter.	
		0102 Thermal assessment shows that cargo elements located within the predicted heating envelope of a failed PLB vent door meet the requirements of ICD–2–19001.		JSC/MT2: Evaluate payloads assessments per Para. 6.1.4.2.1, ICD–2–19001, to assure a failed PLB vent door on entry will not create a hazardous condition to the Orbiter.	
				010101 USA D7003	
				010201 JSC/Customer and Flight Integration Office/MT	

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 013		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Collision/fire/explosion/injury			VERSION: Baseline
HAZARD TITLE: Safety critical functions fail to operate				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Inability to maintain fault tolerance through implementation of Orbiter services, including shared services, required by cargo element(s) for hazard control/monitoring results in injury/death of crew and/or damage/loss of Orbiter due to failure of safety–critical functions to operate.					
APPLICABLE SAFETY REQUIREMENTS: Payload Safety Requirements: NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 201.2    Failure Tolerance – Catastrophic Hazards – Para. 206      Failure Propagation Payload Integration Hardware Requirements: JSC 17481A – Para. 5.1      Failure Tolerance – Para. 5.4      Failure Propagation NSTS 08080–1 – STD–4          Separation of Redundant Equipment – STD–20        Redundant Electrical Circuits – STD–32        Pin Assignment Level II PRCBD S41328, waiver to NSTS 08080–1 wiring standards 4B, 20A, and 32 for payload interfaces. Standards 4B, 20A, and 32 of the earlier version of NSTS 08080–1 are equivalent to B5 and G2 of NSTS 08080–1, 4/1/91. NSTS 16979 Shuttle Orbiter Failure Modes and Fault Tolerances for Interfaces and Services Defined in ICD–2–19001.					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Inappropriate assignment of Orbiter power sources to payloads for maintaining hazard control fault tolerance.		0101 There are no inappropriate assignments of Orbiter power sources to cargo elements, must work functions, or other payload redundancy paths that are identified which can reduce hazard control fault tolerance causing safety critical functions to fail to operate.		USA D7003: Assess flight requirements, ICDs, IDDs, PIPs, payload safety data packages, Failure Mode and Fault Tolerance Document, etc., and the Flight Integrated Schematic to assure no conflict of power assignments that reduce required hazard control fault tolerance. Load test ensures proper power levels are available to payload.	010101 USA D7003

NSTS 21111  
Baseline

4–25

CHANGE NO. 1

NSTS 21111  
Baseline

4-26

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC		GICHR NO: 014		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Injury/Illness			VERSION: Baseline
HAZARD TITLE: Failure to Maintain a Hazard–Free IVA Crew Environment				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Materials offgassing in the crew cabin, electrical shock, excessive high or low touch temperature on the cabin interior or the exterior surfaces of the mid–deck payloads, or improper in–flight maintenance of Orbiter payload services or PIH leads to injury or death of crew.					
APPLICABLE SAFETY REQUIREMENTS: Payload Safety Requirements: NSTS 1700.7B <ul style="list-style-type: none"><li>– Para. 102.2    Responsibility – NSTS</li><li>– Para. 101      Flight Rules</li><li>– Para. 215.1   Hazardous Operations – Hazard Identification</li><li>– Para. 215.2   Exposure to Risk</li><li>– Para. 220.2   et al Crew Habitable Payloads – Habitability</li></ul> Payload Integration Hardware Requirements: JSC 17481A <ul style="list-style-type: none"><li>– Para. 5.1a    Catastrophic Hazards</li><li>– Para. 5.4      Failure Propagation</li></ul>					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 Cumulative and excessive toxic offgas- sing from cargo elements and PIH in the crew cabin.		0101 Proper payload design and construction. Mate- rial analysis and testing, as applicable, deter- mines toxic emissions for PIH and each cargo element. The JSC toxicologist determines that the cumulative toxic emissions are within accept- able limits.		JSC/SD4: Assess payload cabin materials including the PIH for the cumulative toxic effects to assure they are within acceptable limits for crew health.	
02 Improper in–flight maintenance proce- dure implementation exposes the crew to electrical shock or unplanned cargo element operation.		0201 In–flight maintenance electrical shock and inad- vertent operations hazards are controlled through powerdown procedures prior to crew interface. All approved in–flight maintenance procedures contain measures to prevent unintentional grounding, inadvertent operation and electrical shock when a hazard potential exists.		JSC/DO12: Verify that in–flight main- tenance procedures contain the appropriate measures to avoid unintentional grounding, electrical shock and ensure safe in–flight main- tenance activities.	
				020101 JSC/Operations Divi- sion/DO	

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 014		DATE: Feb. 1, 1995
03 Crew is injured from surface contact with combined mid–deck payload whose touch temperature exceeds touch temperature limits.	0301 Thermal interaction between mid–deck payloads or between payloads and Orbiter do not result in crew accessible surfaces exceeding touch temperature limits.	USA D7003: Assess the Payload/(Environmental Control and Life Support System (ECLSS) thermal analysis to assure no crew accessible surfaces exceed touch temperature limits.		030101 USA D7003
04 Inadequate or incompatible procedures, IVA training, IVA tools, and/or IVA training.	0401 IVA work sites, interfaces and procedures were tested and checked out at JSC with flight hardware and training mockups. The flight crew was specifically trained for safety critical IVA scenarios documented in payload hazard reports.	JSC/DO12: Verify that appropriate crew procedures along with crew training assure that no hazardous condition is created for the IVA crew members.		040101 JSC/Operations Division/DO

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC		GICHR NO: 015		DATE: Feb. 1, 1995	
FLIGHT PHASE: All		HAZARD GROUP: Fire/Explosion			VERSION: Baseline
HAZARD TITLE: Loss of Entry Capability				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Inability to cumulatively safe cargo elements for contingency return results in injury/death of crew and/or damage/loss of Orbiter. Shrapnel from the crew escape system decompression panel vent severance assembly at the X <sub>0</sub> 576 bulkhead can penetrate integration hardware or payloads resulting in a fire/explosion or inadvertent operation before the crew can safely escape the Orbiter in an emergency.					
APPLICABLE SAFETY REQUIREMENTS:  NSTS 1700.7B – Para. 102.2    Responsibility – NSTS – Para. 219      Flammable Atmospheres LTR MA3–94–020 Policy Letter on Rapid Safing Payload Integration Hardware Requirements: JSC 17481A – Para. 5.1a      Catastrophic Hazards – Para. 5.4       Failure Propagation					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
RESPONSIBLE VERIFICATION ORGANIZATION					
01 Total time to safe all cargo elements exceeds the rapid safing requirements.		0101 The cargo bay payloads and associated hardware clear the PLBD envelope within 20 minutes. The PLBDs can be closed to support deorbit burn within 30 minutes of declaration of emergency.		JSC/DO12: Ensure that all PLB payloads can clear the PLBD envelope within 20 minutes and support deorbit within 30 minutes or be jettisoned to meet emergency deorbit time constraints.	
		0102 The mid–deck payloads, DSOs, and DTOs do not prevent or delay a contingency return of the Orbiter. They can be cumulatively safed/stowed within 60 minutes.		JSC/DO12: Assess all mid–deck payloads, DSOs, and DTOs to ensure the cumulative time to safe/stow is within the allocated emergency deorbit time constraints.	
		0103 Crew habitable payloads do not delay or prevent a contingency return of the Orbiter. They can be cumulatively safed/stowed within allowable time constraints.		JSC/DO12: Assess all crew habitable volume safing requirements to ensure the cumulative time to safe/stow is within the allocated deorbit timeline.	
				010101 JSC/Operations Division/DO	
				010201 JSC/Operations Division/DO	
				010301 JSC/Operations Division/DO	

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC	GICHR NO: 015		DATE: Feb. 1, 1995
02 Penetration of cargo element hazardous/safety–critical components located in the shrapnel path of the vent severance plate (which explosively releases at 400 ft/sec) in the cargo bay creates a fire/explosion.	0201 Cargo element analysis on the effect of shrapnel penetration demonstrates that a hazardous condition will not exist which could lead to fire/explosion prior to crew escape.	JSC/MT2: Verify the payload has assessed the effect of shrapnel penetration from receipt of penetration analysis letter.	020101 JSC/ Customer and Flight Integration Office/MT
03 Penetration of integration wire harness results in a hazardous condition from short or open failure of critical circuits.	0301 Analysis indicates that shorting of the wire harnesses which contain safety–critical circuits will not cause catastrophic damage to the Orbiter side of the interface prior to crew bailout.  0302 Analysis of payload safety critical circuits demonstrates that no hazardous condition (e.g., explosion, shift of CG, etc.) will arise which will affect the stable gliding flight of the Orbiter which is necessary for crew bailout.	USA D7003: Assess the effect of shrapnel penetration of cargo integration wire harnesses to assure no hazard is created to prevent crew exit.  JSC/MT2: Assess the effect of shrapnel penetration of cargo integration wire harnesses on payload safety critical circuits to assure no hazard is created to prevent crew exit.	030101 USA D7003  030201 JSC/ Customer and Flight Integration Office/MT

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 016		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ground		HAZARD GROUP: Collision			VERSION: Baseline
HAZARD TITLE: Structural Failure of Support Structures and Handling Equipment				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Structure loads and/or handling loads creates a structural failure leading to a hazardous condition resulting in injury/death of crew and/or damage/loss of GSE, facilities and/or Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Load Exceeds Design Strength.		0101 Handling equipment is designed with positive minimum structural design factors of 5.0 against ultimate. The equipment has been proof tested to 2.0 times the rated load. All handling components are either color coded or tethered to insure proper assembly.		KSC/RT–SOE: Assess that handling equipment has a 5.0 positive minimum structural design factor, proof tested to 2.0 times rated load and handling components are either color coded or tethered.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Use of Defective Material or Inadequate Manufacturing.		0201 The lifting/handling equipment/hardware meets NASA safety standards and are tested and inspected to applicable requirements.		KSC/RT–SOE: Assess lifting/handling equipment/hardware against the NASA safety standard, and verify testing and inspection for defective material and/or manufacturing practices.	020101 KSC/Payload and Industrial Safety Division/RT–SOE



**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS—GENERIC		GICHR NO: 017		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ground		HAZARD GROUP: Collision			VERSION: Baseline
HAZARD TITLE: Collision During Handling				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Collision or contact of GSE and/or cargo elements to each other or to the Orbiter damages the GSE, cargo elements and/or the Orbiter resulting in injury/death to ground personnel, crew and/or damage/loss of the Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Human Error.		0101 Detailed operating procedures are developed to minimize the potential for human error. Safety establishes and monitors the control area for hazardous handling operations. Only trained and certified personnel operate handling equipment. In the event of collision, real-time evaluations/inspections are made to determine the extent of the damage and if contingency repairs and re-validation are required.		KSC/RT—SOE: Review operating procedures for potential human errors. Assess handling, hoisting, and movement procedures and control area operations.	010101 KSC/Payload and Industrial Safety Division/RT—SOE
02 Inadequate Safety Features.		0201 Lifting operations are performed utilizing operating procedures which incorporate appropriate cautions and warnings.		KSC/RT—SOE: Assess lifting operations for adequate safety features.	020101 KSC/Payload and Industrial Safety Division/RT—SOE
03 Inadequate Clearance.		0301 Configuration analysis depicts adequate clearance between the payloads and the Orbiter during integration operations.		KSC/RT—SOE: Assess clearances between payloads and payload to Orbiter during integration operations.	030101 KSC/Payload and Industrial Safety Division/RT—SOE

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC	GICHR NO: 018		DATE: Feb. 1, 1995
FLIGHT PHASE: Ground	HAZARD GROUP: Fire/Explosion/Corrosion		VERSION: Baseline
HAZARD TITLE: Inadvertent Release of Corrosive, Toxic, Flammable, or Cryogenic Fluids			CATEGORY: CATASTROPHIC (X)      CRITICAL ( )
HAZARD DESCRIPTION: Inadvertent release of corrosive, toxic, flammable, or cryogenic fluids created by the GSE, ground facilities and/or cargo mix lead to injury/death of ground personnel, crew and/or damage/loss of GSE, facilities and/or Orbiter.			
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 GSE Failures.	0101 GSE is compliant with KHB 1700.7B.	KSC/RT–SOE: Assess GSE for potential inadvertent release of corrosive, toxic, flammable, or cryogenic material.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Human Error.	0201 Inadvertent contact with hazardous or toxic chemicals during ground processing is precluded by conducting these operations in accordance with approved procedures.	KSC/RT–SOE: Assess ground processing procedures for adequate protection against human error.	20101 KSC/Payload and Industrial Safety Division/RT–SOE
03 Elevated GSE Temperatures.	0301 Design the equipment to preclude failure in all predicted environments.	KSC/RT–SOE: Assess design of devices which could produce elevated thermal conditions and verify adequate controls are in place.	030101 KSC/Payload and Industrial Safety Division/RT–SOE

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 019		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ground		HAZARD GROUP: Asphyxiation			VERSION: Baseline
HAZARD TITLE: Loss of Habitable/Breathable Atmosphere				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Facility, GSE, cargo element and/or Orbiter operations lead to a hazardous condition resulting in injury/death to the ground personnel/crew.					
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Offgassing of GSE Materials.		0101 Materials are selected in accordance with KHB 1700.7B.		KSC/RT–SOE: Assess material selec- tion.	010101 KSC/Payload and Indus- trial Safety Division/RT– SOE
02 Oxygen Deficiency.		0201 Nominally operating KSC ventilation systems pro- vide adequate air circulation and ventilation for dispersal of inert gases. In confined space areas, monitoring equipment is utilized to verify habitable atmosphere.		KSC/RT–SOE: Assess ventilation requirements, capability, and moni- toring equipment for habitable vol- umes to assure a respirable atmo- sphere.	020101 KSC/Payload and Indus- trial Safety Division/RT– SOE

**TABLE 4.1**  
**GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued**

MISSION: STS–GENERIC	GICHR NO: 020		DATE: Feb. 1, 1995
FLIGHT PHASE: Ground	HAZARD GROUP: Fire/Explosion		VERSION: Baseline
HAZARD TITLE: Inadvertent Activation of Hazardous Ordnance Devices			CATEGORY: CATASTROPHIC (X)      CRITICAL ( )
HAZARD DESCRIPTION: Inability to maintain fault tolerance and control electrostatic discharge through facility, GSE, Orbiter and/or cargo element(s) results in injury/death of ground personnel/crew and/or damage/loss of Orbiter due to failure to adequately control safety–critical functions related to ordnance devices.			
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Improper Installation, Checkout, or Failure of Electrical Circuitry.	0101 Installation and checkout are performed per approved procedures with the appropriate controls in place. Ordnance circuits are designed per MIL–STD–1512 or MIL–STD–1576.	KSC/RT–SOE: Assess proper design, installation, and checkout of ordnance devices.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Electrostatic Discharge.	0201 Ordnance firing circuits are isolated from other electrical circuits and each other and designed per MIL–STD–1512 or MIL–STD–1576. Prior to ordnance installation, ground isolation and absence of stray voltage are verified.	KSC/RT–SOE: Assess procedures for controlling electrostatic discharge in and around ordnance devices.	020101 KSC/Payload and Industrial Safety Division/RT–SOE

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC		GICHR NO: 021		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ground		HAZARD GROUP: Fire/Explosion			VERSION: Baseline
HAZARD TITLE: Ignition of Flammable Atmosphere/Material				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Incompatibility of GSE/PLB integrated cargo element materials and fluids with each other and cumulatively with the Orbiter lead to fire/explosion that result in injury/death of crew and/or damage/loss of Orbiter.					
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	
				RESPONSIBLE VERIFICATION ORGANIZATION	
01 Use of Flammable GSE Materials Near Credible Ignition Sources.		0101 The use of flammable GSE materials near integrated ground processing is controlled and does not create a hazard.		KSC/RT–SOE: Assess use of flammable GSE materials near credible ignition sources during integrated ground processing.	
02 Presence of Hot Temperature Surfaces.		0201 Accessible high temperature sources are controlled to prevent a hazard to ground personnel.		KSC/RT–SOE: Assess the potential for extreme temperature surfaces accessible to ground personnel for hazard control.	
03 Arcing or Spark Generating Devices.		0301 No arcing or spark generating devices are operated in a flammable atmosphere or near flammable materials.		KSC/RT–SOE: Assess potential arcing and sparking in or around flammable atmospheres and flammable materials.	
				030101 KSC/Payload and Industrial Safety Division/RT–SOE	

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC	GICHR NO: 022		DATE: Feb. 1, 1995
FLIGHT PHASE: Ground	HAZARD GROUP: Injury/Illness		VERSION: Baseline
HAZARD TITLE: Electrical Shock/Burn			CATEGORY: CATASTROPHIC (X)      CRITICAL ( )
HAZARD DESCRIPTION: Electrical shock due to unguarded power supplies or hot connectors leads to injury/death of ground personnel/crew and/or damage to facility, GSE, cargo element(s) or Orbiter.			
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Unguarded Power Supply.	0101 Electrical Ground Support Equipment (EGSE) is compliant with KHB 1700.7B.	KSC/RT–SOE: Assess EGSE equipment for exposed contacts leading to potential electrical shocks and/or burns.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Mismating of Connectors.	0201 The connection of electrical connectors is performed without power applied to the connectors. GSE components are marked and/or keyed to assure proper assembly.	KSC/RT–SOE: Assess design potential for inadvertent demating and/or mismating of connectors and evaluate adequacy of procedures used to remove power prior to mating/demating.	020101 KSC/Payload and Industrial Safety Division/RT–SOE

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC	GICHR NO: 023		DATE: Feb. 1, 1995
FLIGHT PHASE: Ground	HAZARD GROUP: Injury/Illness		VERSION: Baseline
HAZARD TITLE: Personnel Exposure to Excessive Levels of Ionizing or Non–Ionizing Radiation		CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Cargo elements cumulative ionizing or non–ionizing radiation leads to a hazardous condition resulting in injury/death of ground processing personnel/crew.			
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Hazardous Levels of Ionizing Radiation.	0101 Radiation levels are approved by the KSC Radiation Protection Office (RPO).	KSC/RT–SOE: Evaluate use of radioactive materials to protect against personnel exposure to ionizing radiation hazards.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Hazardous Levels of Non–Ionizing Radiation.	0201 Experiments with non–ionizing radiation are in compliance with KHB 1860.2.	KSC/RT–SOE: Assess use of non–ionizing radiation sources for personnel exposure for compliance with KHB 1860.2.	020101 KSC/Payload and Industrial Safety Division/RT–SOE

TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Continued

MISSION: STS–GENERIC	GICHR NO: 024		DATE: Feb. 1, 1995
FLIGHT PHASE: Ground	HAZARD GROUP: Fire/Explosion		VERSION: Baseline
HAZARD TITLE: Hazardous/Incompatible GSE Materials		CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Hazardous/Incompatible facility, GSE, cargo element(s) and/or Orbiter materials leads to injury/death of ground personnel/crew and/or damage/loss of facilities, GSE, cargo elements(s) and/or Orbiter.			
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B			
HAZARD CAUSE:	HAZARD CONTROL:	VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Use of GSE Materials for One Cargo Stack Element is Hazardous to Other Elements of the Integrated Cargo Stack.	0101 The use of hazardous/incompatible GSE materials is controlled.	KSC/SOE: Assess GSE materials used for ground processing to assure use of hazardous or incompatible materials is controlled.	010101 KSC/Payload and Industrial Safety Division/RT–SOE



TABLE 4.1

## GENERIC INTEGRATED CARGO HAZARD REPORTS – Concluded

MISSION: STS–GENERIC		GICHR NO: 025		DATE: Feb. 1, 1995	
FLIGHT PHASE: Ground		HAZARD GROUP: Collision			VERSION: Baseline
HAZARD TITLE: Inadvertent Deployment of Appendages				CATEGORY: CATASTROPHIC (X)      CRITICAL ( )	
HAZARD DESCRIPTION: Inability to maintain fault tolerance through implementation of Orbiter/ground services, including shared services, required by cargo element(s) for hazard control/monitoring results in injury/death of crew or damage/loss of Orbiter due to premature or inadvertent Orbiter/cargo element(s) operation.					
APPLICABLE SAFETY REQUIREMENTS: KHB 1700.7B					
HAZARD CAUSE:		HAZARD CONTROL:		VERIFICATION TASK	RESPONSIBLE VERIFICATION ORGANIZATION
01 Electrical Failure of Appendage Deployment Circuitry.		0101 Deployment circuitry is designed two fault tolerant and inhibits are monitored during ground processing to preclude inadvertent deployment.		KSC/SOE: Assess appendage deployment circuitry for adequate controls.	010101 KSC/Payload and Industrial Safety Division/RT–SOE
02 Inadvertent Issuance of Commands.		0201 Deployment circuitry is designed two fault tolerant and inhibits are monitored during ground processing to preclude inadvertent deployment.		KSC/SOE: Assess for inadvertent commanding to identify adequate controls.	020101 KSC/Payload and Industrial Safety Division/RT–SOE
03 Improper Use of GSE During Verification and Checkout of Spacecraft.		0301 Processing activities are accomplished with trained personnel using approved procedures.		KSC/SOE: Assess GSE operations used during spacecraft verification and checkout to assure only trained personnel and approved procedures are used.	030101 KSC/Payload and Industrial Safety Division/RT–SOE

**APPENDIX A**

**GENERIC INTEGRATED CARGO HAZARD REPORT**

**ACCOUNTABILITY MATRIX**

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# APPENDIX A

## GENERIC INTEGRATED CARGO HAZARD REPORT ACCOUNTABILITY MATRIX

The Generic Integrated Cargo Hazard Report Accountability Matrix provides a tool for use in tracking the verifications on a flight-to-flight basis for each of the individual hazard controls in the GICHRs. This matrix can be copied and filled out for each specific mission by applicable organizations who desire assistance in tracking their respective hazard control and verification responsibilities.

HAZARD REPORT	HAZARD CAUSE	HAZARD CONTROL	ACCOUNTABLE ORGANIZATION
GICHR-001	01	0101	010101 USA D7003
	02	0201	020101 USA D7003
			020102 JSC/Operations Division/DO
	03	0301	030101 JSC/Operations Division/DO
			030102 JSC/Operations Division/DO
GICHR-002	01	0101	010101 JSC/Structures and Mechanics Division/EM
		0201	020101 JSC/Structures and Mechanics Division/EM
GICHR-003	01	0101	010101 USA D7003
	02	0201	020101 USA D7003
GICHR-004	01	0101	010101 JSC/Earth Science and Solar System Exploration Division/SN
GICHR-005	01	0101	010101 USA D7003
	02	0201	020101 USA D7003
	03	0301	030101 USA D7003
GICHR-006	01	0101	010101 USA D7003
	02	0201	020101 USA D7003
GICHR-007	01	0101	010101 USA D7003
			010102 USA D7003
		0102	010201 USA D7003
		0103	010301 USA D7003
	02	0201	020101 JSC/Operations Division/DO
	03	0301	030101 USA D7003
	04	0401	040101 USA D7003
GICHR-008	01	0101	010101 USA D7003
	02	0201	020101 USA D7003

HAZARD REPORT	HAZARD CAUSE	HAZARD CONTROL	ACCOUNTABLE ORGANIZATION
	03	0301	030101 JSC/Operations Division/DO
	04	0401	040101 JSC/Operations Division/DO
GICHR-009	01	0101/2	010101 JSC/Operations Division/DO
	02	0201/2	020101 JSC/Operations Division/DO
	03	0301/2	030101 JSC/Operations Division/DO
	04	0401/2/3	040101 JSC/Operations Division/DO
	05	0501/2/3/4/5	050101 JSC/Operations Division/DO
	06	0601/2	060101 JSC/Operations Division/DO
GICHR-010	01	0101	0101001 USA D7003
GICHR-011	01	0101	010101 JSC/Operations Division/DO
		0201	020101 JSC/Operations Division/DO
GICHR-012	01	0101	010101 USA D7003
		0102	010201 JSC/Customer and Flight Integration Office/MT
GICHR-013	01	0101	010101 USA D7003
	02	0201	020101 USA D7003
			020102 JSC/Operations Division/DO
GICHR-014	01	0101	010101 JSC/Medical Sciences Division/SD
	02	0201	020101 JSC/Operations Division/DO
	03	0301	030101 USA D7003
	04	0401	040101 JSC/Operations Division/DO
GICHR-015	01	0101/2/3	010101 JSC/Operations Division/DO
	02	0201	020101 JSC/Customer and Flight Integration Office/MT
	03	0301	030101 USA D7003
		0302	030201 JSC/Customer and Flight Integration Office/MT
GICHR-016	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-017	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
	03	0301	030101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-018	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
	03	0301	030101 KSC/Payload and Industrial Safety Division/RT-SOE

HAZARD REPORT	HAZARD CAUSE	HAZARD CONTROL	ACCOUNTABLE ORGANIZATION
GICHR-019	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-020	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-021	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
	03	0301	030101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-022	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-023	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-024	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
GICHR-025	01	0101	010101 KSC/Payload and Industrial Safety Division/RT-SOE
	02	0201	020101 KSC/Payload and Industrial Safety Division/RT-SOE
		0301	030101 KSC/Payload and Industrial Safety Division/RT-SOE

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**APPENDIX B**

**GENERIC INTEGRATED CARGO HAZARD TASK  
COORDINATION MATRIX**



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## APPENDIX B

## GENERIC INTEGRATED CARGO HAZARD TASK COORDINATION MATRIX

Responsible Organization	Verification Number	Verification Task	Technical Concurrency
JSC/Operations Division/DO: (DO12:)	01-020102	Verification of Flight Data File for positioning and operation of crew cabin switches to prevent inadvertent or premature occurrence of hazardous events.	Orig.Init.by JMC
	01-030101	Review of integrated payload operating procedures with customer at FOR to assure no conflict of operations with the Orbiter or other payloads results in an inadvertent or premature hazardous event.	Orig.Init.by JMC
	01-030102	Review and completion of integrated training to ensure crew is properly trained to perform safety critical functions.	Orig.Init.by JMC
	07-020101	Assess RMS/Payload operations during RCS firings to ensure that the loads are within the RMS/Orbiter capability to prevent a hazardous condition.	Orig.Init.by JMC
	08-030101	Verify that the analyses, flight procedures, and crew training provide for payload nominal and off-nominal operations in such a manner that prevents collision of the Orbiter and the payloads.	Orig.Init.by JMC
	08-040101	Verify that the flight procedures and crew training assure viewing of hazardous PLB operations or provide telemetry to prevent a hazard to the Orbiter and crew.	Orig.Init.by JMC
	09-010101	Verify the crew translation path(s) and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC
	09-020101	Verify thermal radiation keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC
	09-030101	Verify contamination keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC
	09-040101	Verify stored energy keepout zone(s), tether access area(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC
	09-050101	Verify task complexity, mass handling, fit check(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC

Responsible Organization	Verification Number	Verification Task	Technical Concurrence
	09-060101	Verify radiation source keepout zone(s), crew translation path(s), and work site(s) by accessibility inspections and development of appropriate crew procedures along with crew training to assure that no hazardous condition is created for the EVA crewman.	Orig.Init.by JMC
JSC/Operations Division/DO: (DO12:)	11-010101	Assess cargo element and Orbiter operational procedures and flight rules to assure no conflicts of operations can lead to a hazardous condition to the Orbiter and the crew.	Orig.Init.by JMC
	11-020101	Review operational procedures and flight rules to assure incorporation of payload required operational hazard controls as specified in the payload(s) hazard reports.	Orig.Init.by JMC
	13-020102	Verification of Flight Data File for positioning and operation of crew cabin switches, procedures, and crew training to assure ability to perform must work safety critical functions and associated planned contingencies.	Orig.Init.by JMC
	14-020101	Verify that in-flight maintenance procedures contain the appropriate measures to avoid unintentional grounding, electrical shock and ensure safe in-flight maintenance activities.	Orig.Init.by JMC
	14-040101	Verify that appropriate crew procedures along with crew training assure that no hazardous condition is created for the IVA crew members.	Orig.Init.by JMC
	15-010101	Ensure that all PLB payloads can clear the PLBD envelope within 20 minutes and support deorbit within 30 minutes or be jettisoned to meet emergency deorbit time constraints.	Orig.Init.by JMC
	15-010201	Assess all mid-deck payload DSO and DTOs to ensure the cumulative time to safe/stow is within the allocated emergency de-orbit time constraints.	Orig.Init.by JMC
	15-010301	Assess all crew habitable volume safing requirements to ensure the cumulative time to safe/stow is within the allocated deorbit timeline.	Orig.Init.by JMC
JSC/Manufacturing, Materials Process Technology Division/EM: (EM2:)	02-010101	Assess Payload Integration Hardware MATCO Report and payload flammability assessments to assure no cumulative flame propagation paths exist between the cargo elements and cargo elements and the Orbiter.	Orig.Init.by GKH
	02-020101	Assess cargo elements for planned venting and cumulative effects to assure no adverse reactions that create a hazard to the Orbiter ( i.e., Ignition).	Orig.Init.by GKH

Responsible Organization	Verification Number	Verification Task	Technical Concurrence
USA D7003	05-010101	Assess integration and payloads singular and cumulative non-ionizing radiation effects on other payloads to determine if hazardous conditions are created resulting in a hazardous condition to the Orbiter.	Orig.Init.by AR
	05-020101	Assess integration and payloads singular and cumulative non-ionizing radiation effects on the Orbiter to assure no hazardous condition is created to the Orbiter.	Orig.Init.by AR
	05-030101	Assess integration and payloads singular and cumulative non-ionizing radiation effects to assure no hazardous condition exists to IVA crewman.	Orig.Init.by AR
	06-010101	Assess integration and payloads singular and cumulative conducted emissions to assure no payload hazardous conditions are created that could propagate to the Orbiter.	Orig.Init.by AR
	06-020101	Assess integration and payloads singular and cumulative conducted emissions to assure no hazardous condition is created to the Orbiter.	Orig.Init.by AR
	07-010101	Assess Verification Loads Analysis to assure PIH, including latch assemblies, cumulative load maintains a positive margin of safety for all planned flight and planned contingency conditions.	Orig.Init.by RLN
	07-010201	Assess Vehicle Weight Summary Statement to assure Orbiter end of mission landing weight is within NSTS 07700, Volume X capability. Assess mid-deck payload weights and placements to assure mid-deck payload weight and CG are within the Orbiter capability.	Orig.Init.by RLN and DEJ
	07-010301	Assess Verification Loads Analysis to assure that cumulative interface loads between the Orbiter and the payloads is compatible with the Orbiter capability including planned contingencies.	Orig.Init.by RLN
	07-030101	Assess PLB vent(s) blockage by cargo elements for excessive differential pressure on the Orbiter structure.	Orig.Init.by CRM
	07-040101	Assess cargo element(s) venting of gas for excessive differential pressure on the Orbiter structure.	Orig.Init.by CRM

Responsible Organization	Verification Number	Verification Task	Technical Concurrency
USA D7003	08-020101	Assess the Verification Loads Analysis to assure positive margins due to relative deflections between the Orbiter and the installed cargo element(s)	Orig.Init.by RLN
	10-010101	Assess the Integrated Thermal Analysis for payload mix excessive high or low temperatures and the potential for creating a hazardous condition.	Orig.Init.by CRM
	12-010101	Assess thermal analysis performed on impact to PIH for a failed open PLB vent door to assure no hazardous condition created to the Orbiter.	Orig.Init.by CRM
	14-030101	Assess the Payload/ECLSS thermal analysis to assure no crew accessible surfaces exceed touch temperature limits.	Orig.Init.by CRM
USA D7003	01-010101	Assess flight requirements, ICDs, IDDs, PIPs, payload safety data packages, Failure Modes and Fault Tolerance Document, etc., and the Flight Integrated Schematic to assure no conflict of power assignments that reduce required hazard control fault tolerance.	Orig.Init.by JSS
	01-020101	Assess flight products, related FMEA/CILs, payload safety data packages, Failure Modes and Fault Tolerance Documents, Flight Integrated Schematic, and perform bent pin analysis to assure fault tolerance is maintained to prevent inadvertent or premature hazardous events. Evaluate appropriate OMRSDs/OMIs to assure pre-mate and/or post-mate verification of functionality for control of inadvertent or premature hazardous events.	Orig.Init.by JSS
	03-010101	Assess STS-XX Fuel Cell I-V Performance Predictions, Shuttle Operational Data Submittal WC-R-XXX-XX, for performance margins to support ascent safety requirements.	Orig.Init.by JSS
	03-020101	Determine worst case credible spacecraft on-orbit power whose inadvertent draw during ascent may create a hazard to the Orbiter and ensure that adequate performance margins exist to support ascent safety requirements.	Orig.Init.by JSS
	07-010102	Assess OMRSDs/OMIs to assure prelaunch inspections of the drylube and fiberiloid liners and post-landing turnaround inspection and functional tests of latches.	Orig.Init.by JSS
	08-010101	Assess flight products to assure properly coded installation sequences and positive installation clearances.	Orig.Init.by JSS
	13-010101	Assess flight requirements, ICDs, IDDs, PIPs, payload safety data packages, Failure Mode and Fault Tolerance Document, etc., and the Flight Integrated Schematic to assure no conflict of power assignments that reduce required hazard control fault tolerance. Load test ensures proper power levels are available to payload.	Orig.Init.by JSS

Responsible Organization	Verification Number	Verification Task	Technical Concurrence
	13-020101	Assess flight products, related FMEA/CILs, payload safety data packages, Failure Mode and Fault Tolerance Document, and perform bent pin analysis to assure must-work safety critical functions fault tolerance and redundancy is maintained. Evaluate appropriate OMRSDs/OMIs to assure pre-mate and post-mate verification of functionality for control of must-work safety critical functions.	Orig.Init.by JSS
	15-030101	Assess the effect of vent severance shrapnel penetration of cargo integration wire harnesses to assure no hazard is created to prevent crew exit.	Orig.Init.by JSS
JSC/Customer and Flight Integration Office/MT: (MT2:)	12-010201	Evaluate payloads assessments per Paragraph 6.1.4.2.1, ICD-2-19001, to assure a failed PLB vent door on entry will not create a hazardous condition to the Orbiter.	Orig.Init.by D3
	15-020101	Verify the payload has assessed the effect of vent severance plate shrapnel payload penetration analysis letter.	Orig.Init.by D3
	15-030201	Assess the effect of vent severance shrapnel penetration of cargo integration wire harnesses on payload safety critical circuits to assure no hazard (e.g., explosion, shift of CG, etc.) is created to prevent crew exit.	Orig.Init.by D3
JSC/Medical Sciences Division/SD: (SD4:)	14-010101	Assess payload cabin materials including the PIH for the cumulative toxic effect to assure they are within acceptable limits for crew health.	Orig.Init.by MEC
JSC/Earth Science and Solar System Exploration Division/SN: (SN3:)	04-010101	Review cumulative effect of ionizing radiation from cargo element(s) to determine hazardous condition to other cargo element(s), the Orbiter, and to crew members in the habitable volume.	Orig.Init.by MJG
KSC/Payload and Industrial Safety Division/RT-SOE	16-010101	Assess that handling equipment has a 5.0 positive minimum structural design factor, proof tested to 2.0 times rated load and handling components are either color coded or tethered.	Orig.Init.by JCD
	16-020101	Assess lifting/handling equipment/hardware against the NASA safety standard and verify testing and inspection for defective material and/or manufacturing practices.	Orig.Init.by JCD
	17-010101	Review operating procedures for potential human errors. Assess handling, hoisting, and movement procedures and control areas operations.	Orig.Init.by JCD

Responsible Organization	Verification Number	Verification Task	Technical Concurrence
	17-020101	Assess lifting operations for adequate safety features.	Orig.Init.by JCD
	17-030101	Assess clearances between payloads and payload to Orbiter during integration operations.	Orig.Init.by JCD
KSC/Payload and Industrial Safety Division/RT-SOE	18-010101	Assess GSE for potential inadvertent release of corrosive, toxic, flammable, or cryogenic material.	Orig.Init.by JCD
	18-020101	Assess ground processing procedures for adequate protection against human error.	Orig.Init.by JCD
	18-030101	Assess extreme of devices which could produce elevated thermal conditions and verify adequate controls are in place.	Orig.Init.by JCD
	19-010101	Assess material selection.	Orig.Init.by JCD
	19-020101	Assess ventilation requirements, capabilities, and monitoring equipment for habitable volumes to assure respirable atmosphere.	Orig.Init.by JCD
	20-010101	Assess proper design, installation, and checkout of ordnance devices.	Orig.Init.by JCD
	20-020101	Assess procedures for controlling electrostatic discharge in and around ordnance devices.	Orig.Init.by JCD
	21-010101	Assess use of flammable GSE materials near credible ignition sources during integrated ground processing.	Orig.Init.by JCD
	21-020101	Assess the potential for extreme temperature surfaces accessible to ground personnel for hazard control.	Orig.Init.by JCD
	21-030101	Assess potential arcing and sparking in or around flammable atmospheres and flammable materials.	Orig.Init.by JCD
	22-010101	Assess EGSE equipment exposed contacts leading to potential electrical shocks and/or burns.	Orig.Init.by JCD
	22-020101	Assess design potential for inadvertent demating and/or mismating of connectors and evaluate adequacy of procedures used to remove power prior to mating/demating.	Orig.Init.by JCD
	23-010101	Evaluate use of radioactive materials to protect against personnel exposure to ionizing radiation hazards.	Orig.Init.by JCD

Responsible Organization	Verification Number	Verification Task	Technical Concurrence
	23-020101	Assess use of non-ionizing radiation sources for personnel exposure for compliance with KHB 1860.2.	Orig.Init.by JCD
	24-010101	Assess GSE materials used for ground processing to assure use of hazardous or incompatible materials is controlled.	Orig.Init.by JCD
	25-010101	Assess appendage deployment circuitry for adequate controls.	Orig.Init.by JCD
	25-020101	Assess for inadvertent commanding to identify adequate controls.	Orig.Init.by JCD
	25-030101	Assess GSE procedures used during spacecraft verification and checkout to assure only trained personnel and approved procedures are used.	Orig.Init.by JCD



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**APPENDIX C**

**GENERIC INTEGRATED CARGO HAZARD ORGANIZATION  
POINT OF CONTACT IDENTIFICATION**

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## APPENDIX C

### GENERIC INTEGRATED CARGO HAZARD ORGANIZATION POINT OF CONTACT IDENTIFICATION

<u>Organization</u>	<u>Mailcode</u>	<u>Responsible Representative</u>	<u>Phone Number</u>
Operations Safety Office	DO12	Mark Childress Dennis Knutson	(713) 483-5467 (713) 483-4405
Thermal Branch	ES3	Ray Serna	(713) 483-8876
Materials and Failure Analysis Branch	EM2	Gail Horiuchi	(713) 483-8927
Payload Cargo Engineering	USA D7003	Nelson Fox	(281) 212-6065
Payload Cargo Engineering	USA D7003	Martin Garcia	(281) 212-6066
Payload Cargo Engineering	USA D7003	Lai Lo	(281) 212-6015
Payload Cargo Engineering	USA D7003	Harry Maltby	(281) 212-6014
Customer Integration Office	MT2	William Jordan	(281) 483-1167
Biomedical Operations and Research Branch	SD411	Dr. Martin Coleman	(713) 483-7187
Space Science Branch	SN3	Mike Golightly	(713) 483-6190
Crew Station Branch	SP33	Ray Malone	(713) 483-3737
Payload and Industrial Safety Division	KSC/ RT-SOE	John C. Dollberg Paul Kirkpatrick	(407) 867-6556 (407) 867-6587

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## **APPENDIX D**

### **ACRONYMS**

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## **APPENDIX D**

### **ACRONYMS**

APU	Auxiliary Power Unit
CCTV	Closed Circuit Television
CG	Center of Gravity
CIL	Critical Items List
CoFR	Certificate of Flight Readiness
CR	Change Request
DSO	Detailed Supplementary Objective
DTO	Detailed Test Objective
ECLSS	Environmental Control and Life Support System
EGSE	Electrical Ground Support Equipment
EMU	Extravehicular Mobility Unit
EVA	Extravehicular Activity
FCP	Fuel Cell Performance
FMEA	Failure Modes and Effects Analysis
FOR	Flight Operations Review
GICHAR	Generic Integrated Cargo Hazard Assessment Report
GICHR	Generic Integrated Cargo Hazard Report
GSE	Ground Support Equipment
ICB	Integration Control Board
ICD	Interface Control Document
IDD	Interface Definition Document
ICHAR	Integrated Cargo Hazard Analysis Report
IFM	In-Flight Maintenance
IVA	Intravehicular Activity
LCC	Launch Commit Criteria
MATCO	Material Analysis, Tracking, and Control
OMI	Operations and Maintenance Instruction
OMRSD	Operations and Maintenance Requirements and Specifications Document



PIH	Payload Integration Hardware
PIP	Payload Integration Plan
PLB	Payload Bay
PLBD	Payload Bay Doors
PRCB	Program Requirements Control Board
PRR	Payload Readiness Review
RCS	Reaction Control System
RMS	Remote Manipulator System
SEPS	Spacecraft Electrical Power Simulations
SRB	Solid Rocket Booster
SSP	Space Shuttle Program
SSRP	System Safety Review Panel
USA	United Space Alliance

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